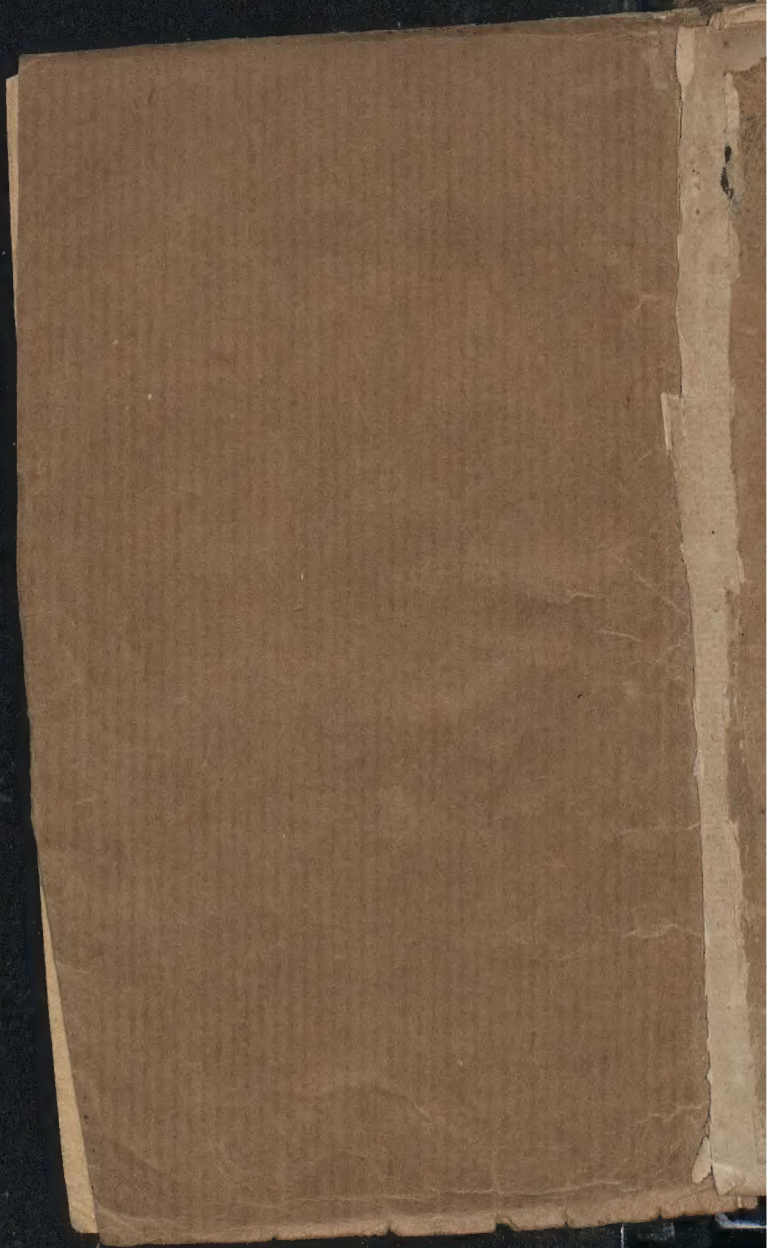




56336-  
56337

Mag. St. Dg.

1



*Jacram vocat Synthesin Geometriam. quod  
omnis facit et vana ab ea scilicet  
pneat esse debeant.*

Synopsis  
**TRIGONOMETRIÆ**  
S I V E  
**DOCTRINÆ TRI-**  
**ANGULORUM,**  
CUM CANONE  
**TRIGONOMETRICO**  
*hoc est* *Vide folio 291 problema*  
**TABULIS**  
Sinuum, Tangentium, Secantium,  
emendatissimis.

*Nunc primum hac formâ portatili edita.*

*à Matern N 40.*

M. PETRO CRÜGERO, REIP.  
Dantiscanæ Mathematico.

*Ejusdem Ausuarium geminum:*

- I. Ratio dimetiendi per quadrantem Altitudi-  
nes & Logitudines.
- II. Supputandi distantias locorum Geographicas.

**DANTISCI** *Vide folio 222*

*Summebus Auctoris: quid debeat nomen  
typis Hancfeldianis. Ipsi videri  
melius amant.*

Anno 1612.

*M. Joannes Brossius Curator noster  
vixit auctor. Donatum possidet 1612.*



Domino Constantino von Sulze  
anno 1633 bibliothecam mon<sup>3</sup>  
strani Academi<sup>2</sup>e Dominica  
Palmarum Hora 23<sup>ra</sup> fer.

Idem Cingarus scripsit  
Trigonometricam Logarithmicam  
Danksia est excusa  
anno 1634.



56326

L



Nobilissimi, Spectabilis & Amplissimi  
DOMINI

GUALTHERI von Holten  
REIPUB. DANTISCANÆ

SENATORIS, peritiâ re-  
rum & linguarum clarissimi,

unicè dilectis Filiis:

CONSTANTINO ASCANIO

&

EHRENFRIIDO JULO

Fratribus germanis

Discipulis meis carissimis

PETRUS CRÜGERUS

S. D. P.



Eometriæ, Nobiles &  
maçti animis Adolescentes,  
tanta est utilitas, ut ejus solius  
ac gemellæ sororis, Arithme-  
ticæ, subsidio

Terrasque tractusque maris cælumque  
profundum

pellustrare detur, tanta necessitas, ut eâ nulla  
queat carere Respublica, tanta dignitas, ut &  
ipse Deus (Plutarchi verbis) *οὐκ ἔστιν ἄλλος*  
*γεωμετρῆς*, quippe qui etiam, sapientissimo re-  
gum teste, omnia ordinavit suo numero, pondere  
& mensura. Quocirca meo quidem judicio  
præposterè admodum agunt, qui studiosæ ju-

ven-

ventuti fores Geometricas præcludunt ante  
lustrata Platonis & Aristotelis Auditoria; con-  
trà ipsius Platonis edictum auditorio suo in-  
scriptum: *ἡδεῖς ἀγεωμέτρητος ἐισίτω*. Causam illi  
prædunt, Geometricarum præceptionum  
difficultatem & obscuritatem. Et certè fuit  
olim, fuit, obscurè & intricatè ubique tradita  
mathesis, quia segniter. Hodie verò magno-  
rum industriâ artificum adeo perspicuè ex-  
culta est, ut amplius obscura videri nequeat  
præterquam obscuris ingeniis. Quid olim in  
Geometricis abstrusius censèbatur doctrinâ  
Triangulorum? à qua etiam multi Mathema-  
tici, tanquam invisio scopulo, abhorrebant. Ea  
verò nunc à *Landspergio, Picisco, & susco Byr-  
gio etc.* (loquor de illis, qui perspicuè, breviter,  
& methodicè scripserunt) sic adornata est, ut  
etiam pueris (ingenui ingenii) cum fructu  
proponi possit. Vidit inter alios, quibus

De meliore luto finxit præcordia Titan,  
hanc Geometriæ perspicuitatem fructuosæ ju-  
cunditati conjunctum DN. PARENS vester,  
ac proinde Vos cum prima literatura, ex insti-  
tuto Platonis & veterum illorum sapientum,  
ad numeros simul & abacum Geometricum  
deduci voluit. Vidit illa qualiacunque verna-  
culo sermone elementa à me Geometrica, à *Io-  
hanne Loffio* hujus Reip. Architecto, viro cla-  
riis, & peritis, Architectonica, vobis præscri-  
pta,



pta, non omninò esse infrugifera. Et jam ad  
praxin menforiam aditum parabamus, cum  
commodè *Synopsin* hanc *doctrinæ Triangulorum*  
publicæ luci destinarem, cui *dimensiones linea-*  
*rum rectarum per Quadrantem*, itemque jucun-

dissimus *distantiæ locorum Geographica calculus*,  
subjuncta sunt. Utrumque cum communi suo  
fundamento, doctrinâ dico Triangulorum,  
Vobis consecrare decrevi, tum PARENTUM  
Vestrorum tum VESTRI causa. PAREN-  
TUM; ut pro assiduis in me beneficiis, quo-  
rum debitorem mori me faciunt, saltem ali-  
quam publicam animi grati tesseram hac ad  
Vos nundinali strena deponerem: VESTRI, ut  
meum erga Vos etiam affectum & promo-  
ventem literas vestras animum apertius osten-  
derem.

Accipite igitur Doctrinam hanc Triangu-  
lorum, omnis Matheseos nucleum & medul-  
lam, cujus hausto succo spondeo vos validos  
& omninò futuros quantacunque moli Ma-  
thematicæ ferendæ pares. DEUS vestro ju-  
ventutis & studiorum flori benedicat, ut is à  
nobiliss. PARENTIBUS impensè plantatus  
à tempore vires capiat &

Crescat occulto, velut arbor, ævo.

*E Musæo meo, nundinis Martinalib.*

*Anni 1612.*

\* 3

LECTO.



# LECTORI MATHEMATICO A U T O R S.

**I**Tanè, forsan ais, excultâ tot præstantissimis  
Artificibus Trigonometriâ, sic ut nihil addi pos-  
se videatur, tu tamen etiam nova scriptione  
prodīs in publicum? Ita sanè, cui causâ, Philoma-  
thes. Nosti, præcepta fusa, qualia sunt Rhetici,  
Regiomontani, Adriani Romani, Finckii, Ma-  
gini, Clavii, non ad palatum esse cuiusvis. Lands-  
pergii & Pitilici contractiora quidem & ex parte  
methodica, sed formâ non æquè portatili. Adria-  
nus Metius Trigonometriam transcursum quasi  
tractat in Astronomia sua: primus autorum, quod  
sciam, qui Canonem Triangulorum integrum exhi-  
buit formâ, qua noster hic est, minore, sed insertum  
libris istis Astronomicis; itaq; non cuilibet emilem.  
Interea tamen comperi tûm in hac Civitate tum in  
Academiis aliquibus optari præcepta simul &  
Canonem Trigonometricum seorsim edita libello  
sic, ut hunc vides, formato. Nolui proinde tam  
discipulis meis quibusdam privatis quam aliis Ma-  
thematicum amantibus operâ meâ deesse: quamvis  
mihi constaret de non exiguo sumtu typographiis  
harum regionum impendendo, deq; diuturno diffi-  
ciliq; circa numeros Canonicos emendatè imprimen-  
dos labore, præsertim cum expertus essem nume-  
ris quorundam autorum non parca subesse vitia,  
etiamsi planè nulla reperiantur promore indicata:  
Non

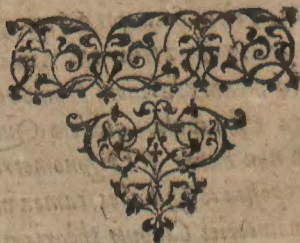
Nonnullos sua quidem indicasse, at non omnia. Adeò ut nequaquam uni soli Auctori, ne quidem Operi Palatino, fidendum. Canonem autem de novo totum retexere, non unius anni laborem esse.

In gratiam ergo Mathematica cultorum emendatas exhibeo tabulas, collatis inter se supradictorum Auctorum Canonibus, ac discrepantiis accurate per differentias & fundamentales regulas examinatis. Cæterùm secunda jam Canonis octernio sub prælo erat, cum fermè labores meos eludere videretur Manuale Mathematicum à Joanne Enocho Meyero Argentorati vernaculè hac ipsa forma nuperrimè editum. In eo non quidem theoria & fundamentum Canonis habetur, sed tamen ipse Canon & praxis Trigonometrica: imò etiam tabula Quadratorum & Cuborum copiosissima. Verùm tractatu pervoluto cum deprehenderem supra 300 in numeris Canonicis errata ab autore indicari (è prima enim Pitisci editione, omnium inter omnes auctores virtuosissimâ, Canonem suum depromsit infelix) & quædam alia subesse non indicata, ut circa Secantes 66. gr. 9 m. 74. gr. 14 m. 89 gr. 27 & 36 m. etc. non amplius habendum, sed meam editionem promovendam censui. In qua etsi tabulas quidem Quadratorum & Cuborum non habes (Trigonometria namque sola mihi proposita est) habes tamen in vicem earum Trigonometrici Canonis theoriam & fundamentum, habes præceptorum & calculi demonstra-



iones, habes calculum Triangulorum non tantum  
planorum sed etiam sphericorum: habes, uno  
vobis, Trigonometriam succinctam, & tamen suffi-  
cientem, methodo quasi Ramæa quantum potui-  
me conformatam. Insuper dimensionem linearum  
rectarum & rationem supputandi locorum distan-  
tias Geographicas.

Errata typographica quæ turbare calculan-  
schemata possint, nusquam videbis: non tam-  
modo, quo apud Landspurgium & alios quosdam  
vitiis numerorum dissimulatis sed quousque  
lorum acies admittit, collatione post impressionem  
reiteratâ, manu meâ per omnia in unum versum  
emplaria correctis. Labor profectò radio-  
spectu quodammodo, in octernione præsertim  
peregrinè absente excusâ) deformis, tuo tam-  
etor, instituto magis proficius quam erratorum Ca-  
talogus. Benè fructu meo operis, & suo re-  
pote Geometriam integram, ut & Astrono-  
miam, expecta.





# RIGONOMETRIÆ SYNOPTICÆ

## CAP. I.

### De Triangulorum & Angu- lorum generibus.

**T**rigonometria, sive doctrina Triangu-  
lorum, est pars Geometriæ de Trianguli  
cujuscunque lateribus & angulis arti-  
ficioso calculo mensurandis.

Non hic prolixè disputabimus de natura Trigonome-  
bjeetum circa quod versatur, est Triangulum; spe-  
triangulata latera & anguli, non item area. Finis  
est laterum & angulorum dimensio. Media dimensionis sunt  
lus adnunculo certarum tabularum subducendus.  
tribus, in definitione positis, quantum sufficit expli-  
candis & pertractandis libellus hic noster occupabitur.

I. Triangulum, hujus doctrinæ Objectum,  
est figura tribus angulis eoridemq; lateribus ter-  
minata.

II. Angulus in genere est superficies par-  
alis duabus lineis comprehensa.

IV. Anguli generalia theorematata sunt:

I. Lineæ comprehendentes angulum vocantur crura anguli.

## TRIGONOMETRIÆ

V. 2. Anguli mensura est arcus Circularis ex angulari puncto tanquam centro descriptus; interque crura satis prolongata interceptus.

Ex angulari puncto cogitur describi circularis arcus, cruribus anguli contentus, intervallo quantum quidem sufficit, si angulus sit planus; sin sphaericus, intervallo quadrantis, non minore vel maiore, distet hic arcus à suo centro, ut infra p. 13. dicetur. Descriptus hic arcus est mensura sui anguli, ita ut quot graduum arcus est, tot graduum esse dicatur angulus.

VI. 3. Tota cujuscunque Circuli peripheria Mathematicis dividitur in partes 360. quæ gradus appellantur: horum singuli more Mathematico constant 60 scrupulis primis, & singula prima 60 secundis &c. Unde semicirculus constat gradibus 180, Quadrans 90.

Divisio hæc est arbitraria: potuisset enim esse partium plurium aut pauciorum, velut apud Hipparchum & alios veteres reperitur partium 83. Hodierna autem commodissima est, quod nullus inter numeros minores invenitur, qui pluribus distribui possit rationalibus partibus. Habent enim hi numeri omnes assis partes, unciam, sextantem, quadrantem, trientem, quincuncem, semissest, septuncem, bessem, dodrantem, dextantem, ac decuncem.

VII. 4. Arcus eodem graduum numero constantes, in Circulis æqualibus dicuntur æquales, in inæqualibus dicuntur similes.

Tam maximus quam minimus quisque Circulus habet 360 gradus: sed majoris Circuli majores etiam sunt gradus. Arcus igitur 60 graduum in Circulo majore dicitur similis arcui totidem graduum in minori.

## C A P. I.

VIII.  $\epsilon$ . Arcuum aut angulorum sunt inter-  
lum Complementa. Complementum arcus  
quadrante minoris est quod ad 90 gradus ipsi  
deest: Complementum arcus quadrante ma-  
joris est, quod ad 180 sive semicirculum deest.

IX. *Angulus in specie consideratur absolute  
& comparatè.*

X. *Absolute & in se consideratus aut est pla-  
nus aut sphericus.*

XI. Planus, cujus crura sunt linea recta in su-  
persficie plana: Sphericus, cujus crura sunt arcus  
maximorum in sphaera Circulorum.

XII. Circuli sphaerae maximi sunt, qui sphaeram  
bisecant, adeoque quorum peripheriae distant à suis  
polis per quadrantem.

Circuli sphaerae maximi sunt quibus majores in eadem  
era dari non possunt. Habent hi circuli non tantum sua  
centra, cum centro sphaerae semper communia: sed etiam  
duos axes, è quorum terminis, qui Poli vocantur, ipsi Cir-  
culi describuntur. Polus à polo distat intervallo semicirculi:  
unde si ex his polis Circulus aliquis maximus adeoque  
sphaeram bisecturus describi debeat, necessarid ejus periphe-  
ria distabit ab utroque polo per quadrantem, intervallo  
scilicet inter utrumq. polum medio.

XIII. *Anguli sphaerici mensura est arcus ex  
angulari puncto tanquam polo descriptus, interque  
crura ad quadrantem continuata comprehensus.*

XIV. *Uterque angulus, tam planus quam sphae-  
ricus, est aut rectus aut obliquus.*



XV. *Rectus, cujus crura sunt inter se recta si-  
ve perpendicularia.*

*Simulacrum eius est Norma artificum.*

XVI. *Mensura ejus est Quadrans circuli si-  
ve 90 gradus, quia si duæ perpendiculares per Circuli  
centrum ducantur, Circulum non aliter quam in 4  
æqualia segmenta diffecabunt.*

*Æquipollens igitur in doctrina Triangulorum Angu-  
lus rectus & Quadrans Circuli, item duo recti & semicir-  
culus, item 4 recti & Circulus integer.*

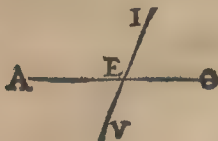
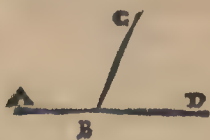
XVII. *Obliquus est, cujus crura sunt inter se  
obliqua sive inclinata.*

XVIII. *Estq; vel acutus vel obtusus. Acutus,  
qui minor est recto: Obtusus, qui major.*

XIX. *Anguli comparatè ad alios considerati  
sunt vel contermini vel alterni.*

XX. *Contermini, sive terminis contigui, sunt  
collaterales & verticales.*

XXI. *Collaterales, vulgò Anguli Deinceps,  
qui super eadem linea utrinq; protensa ad idem pun-  
ctum concurrunt. Verticales, quorum vertex ad  
idem punctum per crucem sunt oppositi.*



# C A P. I.

5

Anguli  $ABC$  &  $CBD$  sunt anguli deinceps: Anguli  $AEI$  &  $VEO$ , item  $IEO$  &  $VEA$ , sunt verticales.

Tyrones attendant, in angulorum per litteras denominatione semper mediam litteram designare ipsum angulare punctum, primam autem & ultimam terminos crurum angularium.

**XXII.** Alterni, quas recta in rectas parallelas incidens intrà alternatim efficit.

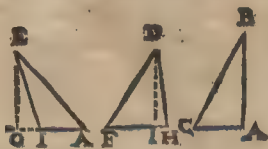


Alterni sunt in hoc schemate primò a-  
cuti  $FGL$  &  $GLM$ , deinde obtusi  $GLK$   
&  $LGI$ . Requiritur ut sint 1. intra duas  
parallelas  $FI$ , &  $KM$ , 2. ad lineam  $HN$   
per has parallelas incedentem, 3. ut sint

alter ad unam parallelam, alter ad alteram: item alter  
ad lineas parallelas transeuntis partem dextram, alter ad  
sinistram.

**XXIII.** Sic de angulis, quantum huic loco suf-  
ficat: Laterum in triangulo sunt hæc theoremata.

1. Unumquodque subtendere dicitur an-  
gulum sibi oppositum: cuius idcirco basis vo-  
catur; & reliqua latera, crura.



Sic in triangulo  $ABC$   
latus  $AC$  subtendit angulum  
oppositum ad  $B$ , cuius & basis  
dicitur: latus autem  $BC$  est  
basis & subtensa anguli ad  $A$ :

latus  $BA$  basis anguli ad  $C$ .

**XXIV.** 2. Latera maiora maiores angulos  
subtendunt; minora minores; æqualia æquales.

A 3

Hec

6

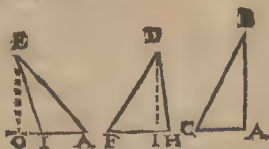
## TRIGONOMETRIÆ

Hoc per se satis clarum demonstratur nihilominus ab  
Eucl. 18. & 19. I.

XXV. 3. Lateral duo quælibet simul sumta sunt  
majora reliquo.

Nisi enim summa duorum esset major latere tertio, cum  
eodem nullam possent construere figuram. *f*

XXVI. Præter angulos & latera Triangulum  
etiam terminatur altitudine: quæ est perpendicularis  
à vertice Trianguli in basin, interdum si opus  
sit continuatam.



Ut in Triangulo ABC  
perpendicularum BA: in Tri-  
angulo DHF perpendicu-  
lum DI: in Triangulo AE  
I perpendicularum EO.

XXVII. Porro Triangulum est vel planum  
vel sphericum. Planum cujus area plana est, &  
latera sunt lineæ rectæ: Sphericum cujus area pars  
est superficiei sphericæ, & latera sunt arcus ma-  
ximorum sphaeræ Circulorum.

Hinc intelligitur, in Triangulo spherico non tantum an-  
gulos, sed & latera gradibus & minutis designari: cum latera  
plani nunc alio atque alio mensurarum genere designantur.

XXVIII. Verumq; dividitur respectu tam an-  
gulorum quàm laterum.

XXIX. Ratione angulorum Triangulum a-  
liud est rectangulum, aliud obliquangulum. Rect-  
angulum, quod unum aut plures habet angulos re-  
ctos: obliquangulum, quod omnes obliquos.

Sed



Sed rectangulum planum non nisi unicum rectum habere potest, ut infra p. 8. c. 3. demonstrabitur.

XXX. Rectanguli rectum unicum habentis latus maximum, angulo recto oppositum, speciatim Hypotenusa dicitur; reliqua rectum includentia, Basis & Cathetus pro libitu.

Hypotenusa est idem quod Subtensa, sic dicta κατὰ ὄψιν, quod subtendat angulum rectum. Sic in Triangulo ABC est BC hypotenusa: AC basis, AB perpendiculū, prout suadet usus. Quae uero & hypotenusa saepe Basis anguli recti vocetur.

XXXI. Ratione Laterum aliud est Equilaterum, aliud inaequilaterum.

XXXII. Equilaterum, quod & Ordinarium dicitur, constat omnibus lateribus æqualibus.

Consequenter etiam æqualibus omnibus angulis per pr. 24. huius cap.

XXXIII. Inaequilaterum est aut Equicrurum aut Scalenon.

XXXIV. Illius latera duo sunt æqualia: huius, omnia inæqualia.

Et sic præcognitum nobis est Objectum huius doctrinae, eo nempe modo, quo Geometra Definitiones & Axiomata propositionibus præmittere solent. Quae de angulorū ac Triangulorū proprietatibus explicanda sunt, seqq. capp. proponuntur.

## CAP. II.

De proprietatibus linearum & angulorum in se consideratorum.

I. Finis Trigonometriae est laterum & angulorum triangularium mensura.

A 4

II. Me

*II. Modia dimensionis sunt partim theoretica, partim practica.*

Ne quis hic Logicus delicatulus cavilletur, sciat Mathematicas disciplinas nec esse merè theoreticas nec merè practicas, sed practicas, ut ita loquar, scientias. Vide Keckermanni Methodum formandorum studiorum & Praecognia nostra Mathematica Geometria præmissa.

*III. Theoretica sunt contemplatio proprietatum linearum & angulis ad praxin necessariis inhaerentium.*

*IV. Lineæ tales & anguli primò considerantur absolute, deinde limitatè.*

*V. Absolute quatenus in superficie plana vel spherica simpliciter existunt absque figura Geometrica.*

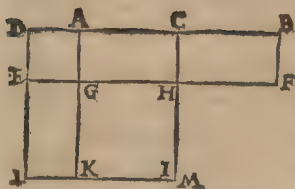
*VI. Hoc modo considerantur aut lineæ solùm, aut lineæ simul & anguli.*

*VII. Lineæ solùm vel una vel plures.*

*VIII. Unius solius proprietates huc pertinentes est Potentia linea rectæ, quæ nihil aliud est quam quadratum ex ea linea tanquam latere factum.*

*IX. Si recta bisecta continuetur; oblongum continuatæ & continuationis cum quadrato bisegmenti æquatur quadrato rectæ è bisegmentato & continuatione compositæ.*

Est 7. e. XIII. Rami è 6. II. Eucl. Si recta quedam *AB* bisecetur in *C*, & ab alterutro termino *A* continuetur aliquodque ad *D*; oblongum *BDE* factum è tota sic continuata



nuata B D & continuatio-  
ne D E (cui equatur D A)  
und cum quadrato G H I  
K dicimus equari qua-  
drato D C M L facto ex  
D C quæ composita est è li-  
nea A o bisegmento A C &

continuatione D A. Brevius: Oblongum D B F E cum sub-  
jecto quadrato G H I K æquatur quadrato majori D C M  
L. Demonstratio facilis est: continetur enim primò qua-  
dratum minus G H I K in majore: in eodem enim conti-  
netur quadratum D A G E, item oblongum A C H G. Ob-  
longum autem C B F H æquatur oblongo E G K L: nam B  
F, A D, D E, E G æquales sunt per structuram: æquales  
etiam C D & D L: jam si ab æqualibus C D & D L aufe-  
rantur æqualia A D & D E (hoc est, B F) reliqua A C &  
E L sunt æqualia. A C autem æquatur C B: ergo & E L  
æquatur C B: ac proinde oblongum C B F H oblongo E G  
K L. Vfus hujus propos. erit in demonstrando calculo, quo  
dati Trianguli plani omnibus lateribus queritur punctum  
lateris: aximi, in quod cadat perpendicularum ex angulo  
opposito demissum: quo cognito in cognitionem angularum  
pervenitur.

X. Linearum plurium ad invicem comparata-  
rum proprietates aliæ sunt rectarum, aliæ spha-  
ricarum.

XI. Rectarum è situ & proportionè.

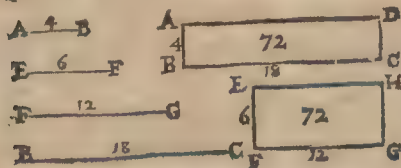
XII. E situ est parallelismus & contactus.

XIII. De parallelismo sunt hæc theorematà.

1. Eidem perpendiculares in se sunt parallelæ: & contrâ.

In prop. seq. nisi  $AB$  &  $DC$  inter se forent parallelæ, non equaliter inclinarent ad tertiam  $BC$ , adeoque non esset utraque ad tertiam perpendicularis, contra thesin.

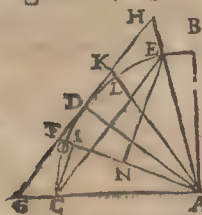
XIV. 2. Parallelæ parallelis terminatæ sunt æquales: & contrâ.



In presenti parallelogrammo  $ABCE$  sicut parallelæ  $AB$  &  $DC$  terminantur parallelis  $AD$  &  $B$

$C$  (latera namq. parallelogrammi cujuscunque opposita sunt parallelæ) ita hæc quoque terminantur ab illis. Non possent autem  $AD$  &  $BC$  esse parallelæ nisi  $AB$  &  $DC$  essent æquales.

XV. Contactus est rectæ tangentis Circulum. Punctum contactus est, ubi radius Circularis in tangentem perpendiculariter incidit.



Contactus fit unico puncto. Ut in presenti diagrammate recta  $GH$  tangit quadrantem  $BC$  in puncto  $D$ , ubi scilicet radius Circularis  $AD$  perpendiculariter incidit in rectam  $GH$ . Ac nisi tangens esset radio perpendicularis sed à perpendiculo deflecteret, ab alterutra parte Circulū secaret, non tangeret.

XVI. Linearum proportionalium theorema est hoc.



Si 4 rectæ sint proportionales; rectangulum mediarum æquatur rectangulo extremarum.

Per 16. VI. Eucl. per numeros demonstratio est evidens.  
 P. 14. Sint 4 rectæ AB partium 4, EF 6, FG 12 & BC 18, inter se proportionales, hoc est, sicut se habet prima ad secundam, ita tertia ad quartam: manifestum est quod si prima ducatur in ultimam, tantundem provenire quantum ex ductu mediarum mutuo.

$$\begin{array}{r} 12 \\ \times 4 \\ \hline 48 \end{array} \quad \begin{array}{r} 18 \\ \times 4 \\ \hline 72 \end{array}$$

CONSECTT. Itaq; 1. datis tribus proportionalibus non potest ignorari quarta: Nam rectangulum mediarum divisum per extremarum unam, prodit alteram.

Vt si ex 4 supra datis, 4, 6, 12, 18, dentur tres priores; rectangulum è 6 & 12, nempe 72, divisum per 4, producit in Quotiente quartam 18. Si cum mediis detur quarta, rectangulum 72 divisum per 18 producit primam 4. Hoc fundamentum est Regula proportionum quam vulgo De tri vocant, quasi regula de tribus numeris quibus inveniendus quartus proportionalis. Neque refert, utrum terminis sic: 4. 6. 12. 18. vel ita: 4. 12. 6. 18. disponantur. Perinde enim est sive dicas, ut 4 ad 6, sic 12 ad 18; sive alternè: ut 4 ad 12 sic 6 ad 18.

Sic etiam inverse: Vt 18 ad 12, sic 6 ad 4. Et

Vt 18 ad 6, sic 12 ad 4.

Et converse: Vt 12 ad 18, sic 4 ad 6. Et

Vt 12 ad 4, sic 18 ad 6.

2. Si tres rectæ sint proportionales, quadratum medię æquatur oblongo extremarum,

Hic

Hic proportio est continua, ubi media bis ponitur, hoc modo: Ut prima ad secundam, sic secunda ad tertiam. E.g. tribus datis numeris, 4. 6. 9. quadratum mediae nempe 36. aequatur ob. ongo ex 4. & 9. facto. Ratio est ex propos. antec. Media enim quia bis supponitur, vicem duarum gerit.

3. Rectangulorum æqualium latera sunt reciproce proportionalia; & contrā.

Est 16. VI. Eucl. Hactenus autem proportio directa fuit, nunc Reciproce mentionem facimus, ubi sicut se habet primus terminus ad tertium, sic quartus ad secundū. Sensus igitur hujus propositi. est, In rectangulis æqualibus esse ut latus minus rectanguli primi ad latus minus secundi, ita latus major secundi ad majus primi. Ut in rectangulis ABCD & EFGH æqualibus est ut AB 4 ad EF 6. sic EH 12 ad BC 18. Per p. 16. conversum etiam sequitur, si duorum rectangulorum latera sint reciproce proportionalia, ipsa rectangula esse æqualia.

XVII. Sphæricarum linearum, hoc est maximorum sphæræ Circulorum, huc pertinentes proprietates duæ sunt.

1. Circuli sphæræ maximi sese mutuo bisecant.

Quemadmodum superficies terminantur & secantur lineis, ita corpora terminantur & secantur superficiebus. Sicut igitur in Circulo diametri plures unâ sese mutuo bisecant in centro circuli: sic circuli sphærici maximi in centro sphæræ. Quilibet enim per se totam sphæram bisecat per p. 12. c. ant.

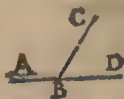
XVIII. 2. Si bisectio fiat per mutuos polos, Circuli sunt ad invicem perpendiculares: & contrā.

Alii

Alii dicunt : Si circulus maximus transeat per alterius maximi polos, est ipsi perpendicularis. In sphaera mundi perpendiculares sunt Meridianus & alii verticales horizoni, Meridianus & alii Circuli declinationum Aequatori, Circuli latitudinum Ecliptica, Duo Coluri cum sibi invicem Aequatori sunt perpendiculares. Demonstratio facilis est. E.g. è polo Aequatoris inter utrumque colurum describatur mensura anguli coluris intercepti, quae mensura erit arcus per quadrantem à polo distans per p. 13. c. ant. (& erit arcus aequatoris). Iste arcus erit quadrans, quia Coluri per mutuos polos ducti sunt : ergo per 16. c. ant. angulus oppositus est rectus, & consequenter per 15. Coluri sunt invicem perpendiculares. Sic de aliis.

**XIX.** Sic de lineis seorsim consideratis : cum angulis consideratarum theoremata 4 sunt.

I. Si recta rectae vel arcus arcui insitit perpendiculariter, facit angulos deinceps rectos : si insitit inclinatè, facit angulos deinceps alterum acutum, alterum obtusum ; quorum aliter est alterius ad duos rectos complementum, ambo verò conjunctim duobus rectis æquales : & contrà.



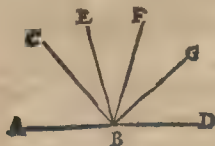
Quatuor sunt hujus theorematìs membra, ordine declaranda. Primum est 10. def. I. Eucl. Si recta CB perpendiculariter insisteret recte AD, utriusque angulorum ad B rectus esset per p. 15. c. antec. Secundò quia insistit inclinatè, ideoque quantum uni rectorum demit, tantundem alteri addit, è quo defectu & excessu fit alter angulorum acutus, alter obtusus. Tertiò aliter est alterius complementum ad duos rectos : & quartò summa

summa amborum est æqualis duobus rectis: quia nempe terminantur eadē linea AD quā terminarentur duo recti, nec super ea linea ex centro B alius arcus describi potest quam semiperipheria, quæ mensura est duorum rectorum. Idem planè cogitandum de arcubus sphericis in alios incidentibus.

CONSECT. Itaque dato uno duorum deinceps angulorum non ignorabitur alter.

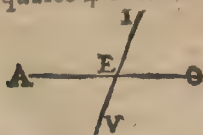
Alter enim substractus à 180 gr. relinquit alterum.

XX. 2. Anguli quocunque ad idem ejusdem lineæ punctum concurrentes conjunctim sunt æquales duobus rectis.



Ut sunt in præsen- ti diagram- mate anguli ABC, CBE, EBF, FBG, GBD. Sunt enim hi minores anguli nihil aliud quam duorum deinceps partes, ut à præcedentibus manifestum est.

XXI. 3. Si recta rectam aut arcus arcum intersectet, anguli per crucem oppositi sunt æquales: omnes autem circa crucem conjuncti sunt æquales 4 rectis.



De cruce perpendiculari res est manifesta: continet enim 4 rector, adeoque omnes æquales. In præsen- ti quoq; cruce dico primum angulos IEO & AEV op-

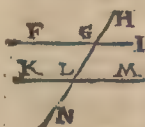
positos esse æquales. Nam IEO & OEV æquantur duobus rectis per 19. hujus cap. itidemq; duobus rectis æquantur OEV & VEA per eand. Ergo duo illa angulorum paria sunt æqualia: à quibus detracto VEO, qui communis est utriq; pari, residui IEO & AEV sunt æquales, per ax. comm. 3.

Eadem



Eadem ratione dico  $AEI \cup VEO$  aequari: nam  $OE V \cup VE A$  sunt aequales duobus rectis, ut  $\cup VE A \cup AEI$ : ergo ab his equalibus angulorum paribus detractus communis  $VE A$ , relinquit aequales  $AEI \cup VEO$ . Dico deniq; omnes circa crucem conjunctim aequari quatuor rectis: quia jam demonstratum est,  $AEI \cup IEO$  duobus rectis aequari, itidemq;  $OE V \cup VE A$  aliis duobus rectis. Adde quod ex angulari puncto  $E$  peripheria summam omnium mensuratur, à quacunque cujuscunque lineæ puncto describi cœperit, eodem puncto finiretur: peripheria verò tota 4 rectorum est mensura per p. 16. cap. ant.

XXII. 4. Si recta in rectas parallelas incidat, angulos similes similiterque sitos & alternos efficit æquales: & contrà.



In presenti schemate, quod  $\cup$  p. 22. c. antec. habuimus, recta  $HN$  incidens in rectas  $FI \cup KM$  parallelas, efficit 1. angulos alternos  $FGL \cup GLM$  acutos aequales, ut  $\cup$  alternos obtusos  $GLK \cup LGI$ , 2. efficit etiam aequales angulos  $FGH \cup KLG$  ut similes similiterq; sitos, itemq;  $HGI \cup GLM$ ;  $\cup$  ex altera parte  $NLM \cup LGI$ , &c. Et hoc sequitur è natura parallelarum: nam si  $HN$  recta est, recta  $FI \cup KM$  aequaliter distare non possunt, nisi ad rectam  $HN$  aequalibus angulis inclinentur. Notandum autem hanc angulorum  $\cup$  linearum proprietatem propriè non competere arcibus  $\cup$  angulis sphericis sed tantum planis.

## De proprietatibus laterum &amp; angulorum Triangularium.

**H**Ætenus de lineis & angulis absolute consideratis; limitatè considerantur, quatenus vel terminum Triangulorum sunt, vel rectæ Circulo ascriptæ.

*II. Terminorum hoc est angulorum & laterum Triangularium adeoque ipsum Triangulorum proprietas una est quæ Triangulis tam planis quam sphericis competit, nempe hæc:*

Si Triangulum sit æquicetrum, anguli ad basin invicem æquantur, & continuatæ cruribus etiam externi infra basin anguli æquantur.

Interni quidem per p. 24. c. 1. Externi verd, quia cum suis internis per p. 19. c. 2. æquales sunt binis rectis: Stigitur quilibet internus auferatur à duobus rectis, relinquuntur æquales externi. Vide quàm facile demonstrari possit hæc propositio, quæ tamen olim in scholis crux & furga miserorum est appellata.

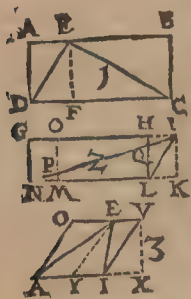
*III. Cætera proprietates sunt aut planorum aut sphericorum.*

*IV. Et planorum aliæ quibuscunque Triangulis communes, aliæ certo generi speciales.*

*V. Communes hæc sunt:*

*1. Si Triangulum tam basi quam altitudine sit æquale parallelogrammo, area ejus ad aream parallelogrammi est subdupla.*

*Quo*



Quod ad oculum patet, primò in Triangulo DEC cōparato ad rectangulum ABCD, ubi perpendicularum EF altitudinem Trianguli per p. 26. cap. 1. definens & lateri rectanguli parallela cadit intra Triangulum efficiens  $\Delta$ lum novum DEF æquale  $\Delta$ lo DEA propter rectas AE & DF item EF & AD per 13. & 14. c. 2. parallelas & æquales : iisdem de causis etiam

$\Delta$ lum EFC, & CEB sunt æqualia : ita ut rectangulum ABCD comprehendat  $\Delta$ lum DEC duplicatum.

Secundò in  $\Delta$ lo NIL comparato itidem ad rectangulum GHLN, sed ubi perpendicularum IK lateri rectanguli parallelum cadit extrà in basin NL continuatam ad K. Nam si rectangulum particulare HIKL reponatur interius ad GOMN, erit rectangulum GHLN æquale rectangulo OIKM, itemq;  $\Delta$ lum particulare NPM particulari HIQ æquale per prop. ante cit. Patet itaque trapezium OPQH æquari trapezio PQLM, &  $\Delta$ lum QLI cum IHQ sive NPM (hoc est totum IHL) æquari  $\Delta$ lo ILK. Proinde rectangulum OIKM sive GHLN continet duplum  $\Delta$ li NIL.

Tertiò in  $\Delta$ lo AEI comparato ad parall. obliquangulum OVI A, cuius &  $\Delta$ li altitudo VX. Ducatur è vertice  $\Delta$ li E recta ET parallelogr. lateribus OA & VI (sicut & in prioribus figuris) parallela : manifestum est propter æquales parallelas OE & AT item OA & ET  $\Delta$ lum AOE  $\Delta$ lo EAT æquari : ut &  $\Delta$ lum IET  $\Delta$ lo EIV propter æquales parallelas EV & TI item ET & VI. Patet itaque propositum.


Triad.



VI. 2. Triangula vel parallelogramma æquealta sunt ut bases.

Hoc est: sicut se habet basis unius ad basin alterius, ita area unius ad aream alterius & contrà; si scilicet fuerint ejusdem altitudinis. Notent autem tyrones, in parallelogrammis esse bases geminas, nempe latera opposita. In præced. prop. figura secunda sicut se habet  $NL$  basis parallelogrammi  $NLHG$  ad  $LK$  basin parall.  $LKIH$ , sic area prioris est ad aream posterioris. Item in tertia figura, ut  $AT$  ad  $TI$  sic area  $ATEO$  ad aream  $TIVE$ . Ratio naturalis est, quia area tantum uniformiter propagantur unà cum basibus, altitudine manente: igitur qua proportionem dilatantur bases, eadem crescunt & area. Quod in parallelogrammis demonstratum derivatur ad Triangula, quorum area subdupla sunt ad areas parallelogrammorum sibi æquealiorum aqua basi per p. præc. Nam ut basis ad basin, sic area subdupla basis unius ad subduplam alterius. Erit igitur in figura secunda, ut  $NL$  ad  $LK$ , sic Triangulum  $NLI$  ad Triangulum  $LKI$ : & in tertia, ut  $AT$  ad  $TI$ , sic  $\Delta$ lum  $ATE$  ad  $\Delta$ lum  $TIE$ . Et contrà ut  $\Delta$ lum ad  $\Delta$ lum sic basis prioris ad basin posterioris.

VII. 3. Trianguli plani latere quocunque continuato; angulus, qui ex continuatione fit externus est æqualis duobus internis huic oppositis.

Esse Triangulum  $ABC$ , cujus latus quodcunque  $AC$  continuetur in  $D$ , ut fiat angulus externus  $BCD$ , quem dico duobus internis ad  $A$  &  $B$  simul sumtis æquari. Ducta namq̃  

 $CE$

CE parallela lateri AB facit angulum BCE alterno ABC equalem per p. ult. cap. præc. Per eandem etiam angulus ECD æquatur similiter suo BAC: atque ita externus BCD ex particularibus BCE & ECD compositus æquatur internis oppositis.

VIII. 4. Trianguli plani tres anguli conjunctim sunt æquales duobus rectis.

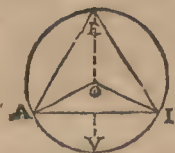
Est 32. I. Eucl. ad plurimas demonstrationes necessaria. Ipsa sic demonstratur: In Triangulo proximè præc. anguli externus BCD complementum ad duos rectos est internus deinceps ACB per p. 19. c. præc. Ipsi verò externo per p. jam add. præcedentem demonstratum est æquari internos ad A & B conjunctim. Ergo tres interni tantum valent quantum externus cum suo deinceps complemento, hoc est, æquivalent duobus rectis.

CONSECTT. Itaque 1. In Triangulo plano non potest nisi unus esse rectus vel obtusus: cæteris necessariò acutis.

2. Duorum quorumcunque complementum ad duos rectos est tertius,

3. In Triangulo rectangulo acutorum alter est alterius complementum ad unum rectum seu quadrantem.

IX. 5. Si duo Triangula inscribantur eadem Circulo eadem basi, sed vertice alterius in centro, alterius in peripheria; angulus ad centrum duplus est anguli ad peripheriam.

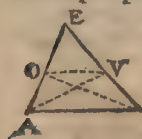


Duorum  $\Delta$ lorum  $AEI$  &  $AOI$  eidem circulo inscriptorum eadem basi  $AI$ , vertice alterius ad  $E$ , alterius ad centrum  $O$ , dico angulum ad  $O$  duplum esse anguli ad  $E$ . Ducta namq; per  $\Delta$ lorum vertices diametro  $EO$  &  $VO$  sunt duo  $\Delta$ la æquicrura  $AE O$  &  $EO I$ : in quibus per p. 2. hujus cap. angulus  $AE O$  æquatur angulo  $EAO$ , item angulus  $OEI$  angulo  $OIE$ . Externus autem  $AOV$  per p. 7. æquatur internis ad  $A$  &  $E$   $\Delta$ li  $AE O$  item externus  $VOI$  æquatur internis ad  $E$  &  $I$   $\Delta$ li  $EOI$ . Ergo  $AOV$  duplus est anguli  $AE O$ , &  $VOI$  duplus anguli  $OEI$ : atque ita totus  $AOI$  duplus est totius  $AEI$ .

CONSECT. Itaque Triangula eidem Circuli sectioni inscripta, sunt verticibus æquiangula.

Singulorum enim anguli ad verticem semisses sunt anguli ad centrum: cujus anguli basis cum basibus reliquorum  $\Delta$ lorum communis est.

X. 6. In Triangulo plano parallela basi secatur proportionaliter.



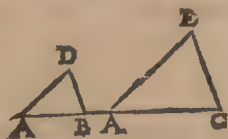
Est 2 VI. Eucl. In  $\Delta$ lo  $AEI$  recta  $OV$  parallela basi  $AI$  secat crura  $EA$  &  $EI$  proportionaliter in  $O$  &  $V$ , ita scilicet ut sit velut  $AO$  ad  $OE$  sic  $IV$  ad  $VE$  & c.

Ductis enim rectis aliis  $OI$  &  $VA$  sunt duo  $\Delta$ lorum paria æque alta, 1.  $EVO$  &  $OVA$ , 2.  $EOV$  &  $VOI$ . Proinde per p. 6 hujus c. erunt ut  $\Delta$ lum  $EVO$  ad basin  $EO$ , sic  $\Delta$ lum  $OVA$  ad basin  $OA$ : item ut  $\Delta$ lum  $EOV$  ad basin  $EV$ , sic  $\Delta$ lum  $VOI$  ad basin  $VI$ . At qui etiam est ut  $\Delta$ lum  $EOV$  ad  $\Delta$ lum  $OVA$ , sic idem



idem  $\Delta$ lum  $EVO$  ad  $\Delta$ lum  $VOI$ . Ergo etiam ut basis  $EO$  ad basin  $EA$ , sic basis  $EV$  ad basin  $EI$ . Proportionaliter itaque crura  $EA$  &  $EI$   $\Delta$ li  $AEI$  secta sunt in  $O$  &  $V$ : quod erat demonstrandum.

XI. 7. Si duo vel plura Triangula binis angulis sint æquiangula, prorsus æquiangula sunt, & similia vocantur.



Ut in hisce duobus  $\Delta$ lis si  $\Delta$ li minoris angulus ad  $A$  equalis fuerit angulo  $\Delta$ li majoris ad  $A$  & angulus ad  $D$  angulo ad  $E$ , necessariò quoque  $\Delta$ li minoris tertius æquatur tertio majoris. Nam in utroque summa trium est equalis duobus rectis per p. 8. hujus cap. Ablatâ itaque in utroque  $\Delta$ lo duorum equalium summa à duobus rectis residui relinquuntur æquales. Igitur si Triangula binis angulis sint æquiangula, etiam tertio sunt æquiangula. Et talia Triangula vocantur Similia.

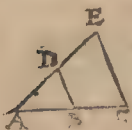
XII. 8. In Triangulo parallela basi desecat particulare Triangulum simile toti.

Sic propof. 10. Triangulum  $EVO$  à recta  $OV$  resectum simile fit toti  $AEI$ . Angulus enim ad  $E$  utrique Triangulo communis est;  $EVO$  verò &  $EIA$  similiter siti ac proinde per p. ult. c. 2. æquales. Similiter etiam siti sunt & æquales  $EOV$ , &  $EAI$ . Ergo singuli in Triangulo minori æquantur singulis in majori.

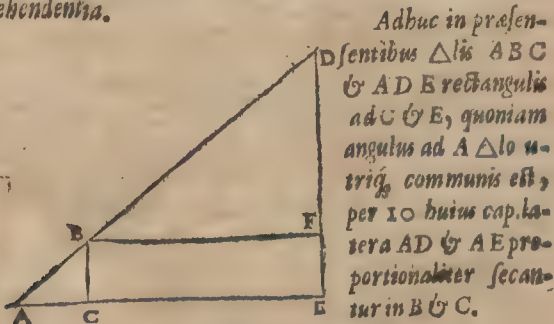
XIII. 9. Triangula similia sunt lateribus æquales angulos comprehendentibus proportionalia.

Est 4. VI. *Euch.* totius Geometria, si spectes utilitatem, præstan-

præstantissima & verè aurea propositio. Quippe basis est omnium, quæ terra, mari, cælo, sunt, dimensionum. Sumto duo Triangula prop. 11. quæ æquiangularia sint ex thesi, præinde si AD applicetur ad AE, necessariò AB caderet in AC, & propter æquales angulos ad D & E latera reliqua DB & EC erunt parallela, fietq; DB inscripta Trianguli majoris. In quo si ex concessu p. 23. c. 1



EC assumatur ut basis, manifestum est DB per p. 10. huius cap. secare crura AE & AC proportionaliter in punctis D & B: Vt sit velut AD ad DE, sic AB ad BC: & alternè ut AD ad AB, sic DE ad BC: ergo etiam ut AD ad AE, sic AB ad AC: vel alternè ut AD ad AB, sic AE ad AC: & inverse ut AC ad AB, sic AE ad AD &c. Latera igitur AD & AB minoris  $\triangle$  li angulum A comprehendentia sunt proportionalia majoris  $\triangle$  li lateribus AE & AC, æqualem priori angulum (hoc loco eundem) comprehendentia.



Adhuc in presentibus  $\triangle$ lis ABC & ADE rectangulis ad C & E, quoniam angulus ad A  $\triangle$ lo utriq; communis est, per 10 huius cap. latera AD & AE proportionaliter secantur in B & C.

Proportionēs hæc sunt; alternis omisiss:

Vt AD ad AE,

Sic AB ad AC:

Vt AD ad DE,

Sic AB ad BC:

Vt AE ad ED,

Sic AC ad CB: rursusq;

Vt AB ad AC, Sic AD ad AE:

Vt AB ad BC, Sic AD ad DE:

Vt AC ad CB, Sic AE ad ED. Variationes

plures te docebit usus. Tot etiam habebis, ductâ rectâ BF parallelâ ad CE. Labet propositionem utilissimam & secundissimam etiam exemplo practico hic illustrare. Sit DE turris aut alia quæpiam altitudo ad horizonem AE recta: hujus umbra forte spargatur ad usque A. Erecto ad perpendicularum baculo BC sic ut extremitas umbrae à baculo sparsa cadat etiam in A. Mensuretur baculus & esto forte 5 pedum: mensuretur & ejus umbra AC, quæ esto 7 pedum: mensuretur denique turris umbra AE 66 pedum. Quoniam igitur baculus BC & altitudo DE per p. 13. c. 2. parallele sunt, erunt anguli ad C & E recti, extremus autem radius Solaris DA duo Triangula facit, DAE & BAC, similia propter rectos ad C & E & propter communem ad A. Quare per regulam proportionum ita collige:

Sicut est umbra baculi Ad ipsum baculum CB 5.

AC 7 pedum, pedum:

Ita est umbra altitudin. Ad ipsam altitudinem 47.

AE 66 pedum, pedum.

Sed longè elegantiores dimetiendi modos hac propositione postmodum procreabit.

XIV. Speciales proprietates istæ sunt.

I. In Triangulo æquilatèro quilibet angulus est bes recti. (gr. 180.

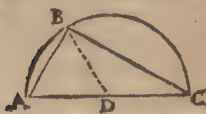
Hoc est 60 gr. per p. 8. Omnes enim tres habere debent

XV. 2. Si trianguli angulus quidam æquatur duobus reliquis, est rectus.

Per eandem p. 8. hujus cap. quia est semissis duorum rectorum, hoc est, summa omnium trium.



XVI. 3. Si trianguli latus maximum sit diameter Circuli, angulus oppositus est rectus.



Vulgò: Angulus in semicirculo rectus est Ut in presenti Triangulo A B C quia latus A C possit esse diameter Circuli, dico angulum ad B rectum esse. Ducto namq; circulari radio BD, sunt duo  $\Delta$ la particularia æquicrura ABD & D B C propter radios Circulares D A, D B & D C. In hisce  $\Delta$ lis per p. 2. hujus cap. angulus D B C æquatur angulo C, & angulus A B D angulo B A D; & sic  $\Delta$ li propositi A B C angulus ad B totus æquatur duobus reliquis ad A & C: proinde per p. 15. rectus est.

XVII. 4. Si Triangulum sit rectangulum simul & æquicrurum, uterque ad hypotenusam angulus est semissis recti.

Quia juncti constituunt alterum rectum per p. 8. ambo verò sunt invicem æquales per p. 2.

XVIII. 5. In Triangulo rectangulo perpendicularis ex angulo recto in basin efficit particularia duo Triangula, similia inter se & toti.



Inter jucundissimas & utilissimas Geometrie propositiones & hæc est Eucl. 8. VI. In Triangulo A B C ad A rectangulo perpendicularẽ demissam ex A in hypotenusam CB dico efficere duo nova Triangula C A D & D A B similia inter se & toti A B C. Primum namq; totum & particulare C A D per 11. hujus cap. similia sunt propter rectos C D A & C A B,

$CAB$ , propterq<sup>3</sup> cōmunem ad  $C$ . Deinde totum & particulare  $DAB$  per eandem similia sunt propter rectos  $BDA$  &  $CAB$  propterq<sup>3</sup> communem ad  $B$ . Denique cum particularia uni tertio sint similia, inter se quoque sunt similia, per axiom. Geom. communia.

**XIX. 6.** In Triangulo rectangulo perpendicularis ex angulo recto in basin est media proportionalis inter segmenta basis: & crus utrumlibet est medium proportionale inter basin & basis segmentum ipsi cruri conterminum.

In  $\Delta$ lo proximo 1. perpendicularem  $AD$  dico mediam proportionalem esse inter basis segmenta  $CD$  &  $DB$ : quia namq<sup>3</sup> per prop. prec. Triangulum  $CDA$   $\Delta$ lo  $DAB$  equiangulum est, erit etiam per p. 13.  $CD$  ad  $DA$ , sic  $DA$  ad  $DB$  & contrā propter angulum ad  $D$  in utroque Triangulo rectum, hoc est aequalem. 2. Dico crus  $CA$  medium proportionale esse inter basin totam  $CB$  & basis segmentum  $CD$  cruri  $CA$  adjacens: cum enim Triangulum  $CDA$  toti  $CBA$  per p. antec. simile sit, erit etiam ut  $CB$  hypotenusā majoris ad  $CA$  hypotenusam minoris, sic eadem  $CA$  crus minus Trianguli majoris ad  $CD$  crus minus minoris & contrā, propter angulum ad  $C$  utriq<sup>3</sup> Triangulo communem id est sibiipsi aqualissimum. 3. Eadem ratione ut  $CB$  hypotenusā Trianguli majoris ad  $BA$  hypotenusam minoris  $ABD$ , sic eadem  $AB$  crus majus Trianguli majoris ad  $BD$  crus majus Trianguli minoris. Constat itaque propositum.

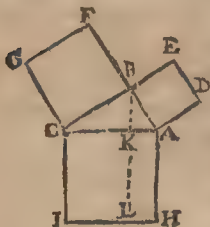
**XX. 7.** In Triangulo rectangulo anguli recti basis æquè potest cruribus: & contrā.

Vel: Latera comprehendentia rectam æquè possunt hy-

B S

potenusæ

potenusa: hoc est, (ut p. 8. c. 2. explicat)  $\square$ rum ex hypotenusa factum æquatur  $\square$ ris reliquorum laterum simul sumtis. Est illa celebratissima 47. I. Eucl. apud ipsum & plerisque satis obscure & anfractuose demonstrata: Pitiscus eam demonstrat perspicue & facillime hoc modo.



Descriptis hypotenusa & crurum quadratis, ex angulo recto B demittatur perpendicularis BK in in ejus basin AC, eaq; continuetur per totum basis quadratum usque in L. Quo ipso quadratum secatur in duo oblonga: quorum unum AHLK æquari dicimus quadrato

ABED alterum KLIC quadrato BFGC, atque ita ambo quadrata ABED & BFGC simul sumta quadrato AHIC. Nam quia per p. antec. tres rectæ AK, AB, & AC sive AH sunt proportionales, ideo per 2. Conf p. 16. c. 2. quadratum è media factum æquatur oblongo AHLK ab extremis AC (hoc est, AH) & AK facto. Iisdem de causis quia alia tres rectæ, KC, CB & CA sive CI, sunt proportionales, quadratum CBFG æquatur oblongo CKLI: atque ita duo quadrata ABED & BCFG simul sumta æquantur quadrato toti AHIC: quod erat demonstrandum.

CONSECT. Igitur in Triangulo rectangulo datis duobus quibuscunque lateribus non potest ignorari tertium,

Nam si detur utrumque crus anguli recti & desideretur hypotenusa; cruris utriusque quadrata invicem adduntur,

duntur, èq<sup>ue</sup> summa extrahitur Radix quadrata, ea erit hypotenusa. Sin detur hypotenusa cum alterutro crure; desidereturq<sup>ue</sup> crus alterum; dati cruris quadratum subtrahitur à quadrato hypotenuse, è residuo extracta radix quadrata est crus quæsitum. Ad hanc igitur Triangulorum datam requiritur notitia extrahenda radicis quadrata, ab Arithmeticis petenda.

XXI. Hæ fuerunt proprietates laterum & angulorum in Triangulis planis: Sphæricorum iidem sunt generales & speciales.

XXII. Generales hæ sunt.

1. In Triangulo sphærico si anguli crura continentur, denuò concurrent, angulo à priori per semicirculum remoto, eidemque æquali.

Crura sunt arcus maximorum circulorum per p. I I. c. I. Circuli maximi sese bisecant per 12. ejusdem c. ideoque peripheriarum intersectio gemina est in punctis sc. oppositis. Puncta sphaerae opposita distant ab invicem semicirculo. Sunt enim extremitates diametrorum. Angulorum utriusque intersectionis mensura distat ab his punctis intervallo quadrantis per p. 12. c. I. igitur utriusque anguli eadem est mensura ac proinde ipsi anguli sunt æquales.

XXIII. 2. Triangulo sphærico cuiusvis è regione cujusvis anguli opponitur Triangulum aliud, basi communi, anguloq<sup>ue</sup> è regione æquali; cæteris lateribus & angulis laterum & angulorum priorum complementis ad semicirculum.



Per p. præcedentem & per 19. c. 2. Exemplo è sphaera mundi desumpto rem illustrabimus. Cogitetur Triangulum, cujus unum latus sit arcus horizonis exempli gratia gr. 33. alterum arcus Aequatoris gr. 26. angulo cruribus his intercepto 35 gr. tertium latus erit arcus circuli cujusdam maximæ generalis gr. 18. m. 19. terminos priorum laterum connectens, anguli reliqui sint ad horizontem quidem 53 gr. 3 m. ad Aequatorem verò 96 gr. 10 m. Priora duo latera si trans tertium continuantur, iterum concurrent angulo ad priorem horizontem & Aequatore comprehensum æquali per p. præc. Constituunturq; novum Triangulum, cujus unum latus cum prioris Trianguli tertio latere commune est gr. 18. min. 19. reliqua latera quia singula cum illis, à quibus continuata sunt, semicirculum constituent, sunt eorundem ad semicirculos complementa: sic & anguli reliqui sunt priorum singuli complementa ad semicirculos, quia sunt anguli Deinceps per p. 19. cap. 2. Erit itaque latus ab arcu Aequatoris factum 154 gr. angulus adjacens 83 gr. 50 m. latus ab horizonte generatum 147 gr. angulus adjacens 126 gr. 57 min.

XXIV. 3. Trianguli sphaerici latera in angulos, & contrà, converti possunt, assumtis scilicet pro latere & angulo maximo complementis eorundem ad semicirculum.



In præsentî figura Circulus A BCDE sit meridianus, ALE horizon, BKF æquator, DOH Circulus declinationum, COG verticalis. Assumpto verò Triangulo CDO erit per p. 13. c. 1. anguli D mensura arcus æquatoris BO anguli

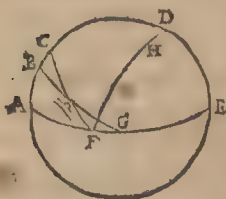
anguli ad C externi (complemento scilicet interni ad semiculum assumpto, ut docet theorema) mensura erit arcus horizonis AL, anguli denique ad O mensura est arcus HN alterius Circuli declinationum continuatus per punctum æquatoris P in horizontem ad M. Sicut autem quadrantes sunt BK & KF, AK & KE: ita etiam quadrantes sunt OP & LM, item sicut quadrans est HP (scilicet ex O intersectione Æquatoris & Circuli declinationum descriptus) ita quadrans est NM, ut AL & KM, BO & KP, HN & PM sint arcus æquales. Cum igitur AL mensura anguli C æquetur arcui KM, item BO mensura anguli D arcui KP, denique HN mensura anguli O arcui PM, jam patet Trianguli KMP tria latera æquari tribus angulis Trianguli CDO. Contrà etiam Anguli illius Trianguli æquantur lateribus huius. Nam anguli ad K mensura est elevatio æquatoris AB, cui æquatur complementum elevationis poli DC: Anguli ad M mensura est arcus LN, cui æquatur OC, siquidem non tantum CL & LG sed etiam ON quadrantes sunt: denique angulus ad P per p. 18. c. 2. rectus est, ergo eius mensura æquatur quadranti DO. Hoc exemplum perspicuum è sphaera mundi selegi, ne minus assueti aliqua demonstrationis obscuritate deterrentur. Insignis est huius theorematibus usus in analysi quorundam Triangulorum sphaericorum.

XXV. Speciales sphaericorum proprietates sequuntur. Primò rectangulorum.

I. Trianguli sphaerici rectanguli interdum unus tantum est angulus rectus, interdum plures.

XXVI. 2. Si fuerit unus, erunt reliqui vel acuti,

acuti, tumq; huic rectangulo opponitur aliud rectangulum cum duobus obtusis: vel obtusi, ac tum huic  $\Delta$ lo opponitur aliud rectangulū cum duobus acutis: vel denique alter obtusus alter acutus, tumque acuto opponitur Triangulum rectangulum cum duobus acutis.



Est  $ABCD$  Meridianus,  $AF$   $E$  horizon,  $B \hat{=} G$  arcus æquatoris,  $C \hat{=} F$  arcus Eclipticæ, cujus polus  $H$  in arcu Circuli latitudinum  $DHF$ . Triangulum Rectangulum cum duobus acutis est  $ACF$ , huic oppositum triangulum  $CFE$  rectangulum est ad  $E$  cum duobus obtusis ad  $F$  &  $C$ . Triangulum autem  $FDE$  rectangulum ad  $E$  habet unum acutum ad  $F$  alterum obtusum ad  $D$ .

XXVII. 3. Rectanguli cum duobus acutis latera singula sunt quadrantibus minora: cum duobus obtusis, latera his opposita sunt quadrante maiora, tertium quadrante minus.

XXVIII. 4. Si fuerint in Triangulo recti plures, erunt illi vel duo vel tres: Latera verò rectos subtendentia sunt quadrantes.

XXIX. 5. Si tertius sit obtusus, latus tertium est quadrante majus; sin acutus, erit id quadrante minus.

Omnia per p. 13. 16. & 24. c. 1.

XXX. Deinde obliquangulorum.

i. Triangulo merè acutangulo opponitur aliud cum uno acuto & duobus obtusis.

XXXI. 2. Me-

## CAP. IV.

31

XXXI. 2. Merè obtusangulo opponitur aliud cum uno obtuso & duobus acutis.

XXXII. 3. Ex obtusis & acutis mixto, si fuerit unius acuti, opponitur merè acutangulum: sin unius obtusi, purobtusangulum.

## CAP. IV.

### De Subtensis, Sinibus, Tangentibus & Secantibus.

I. *Tantum de lineis & angulis Triangulorum: sequuntur lineæ rectæ Circulo ascriptæ.*

II. *Harum aliæ Circulo inscribuntur, aliæ Circulum tangunt, aliæ etiam secant.*

III. *Inscriptarum quædam dicuntur Subtensæ quædam Sinus.*

IV. *Subtensæ dicuntur, quæ Circularibus arcibus subtenduntur, eosque terminant: alio nomine vocantur & Chordæ.*

V. *Suntque vel generales & simpliciter dictæ vel speciales & limitatæ.*

VI. *Generalium sunt hæc theorematæ.*

I. *Subtensæ dicitur & arcus, & reliqui ad integrum Circulum complementi.*

*Qualibet*





Qualibet subtensa Circulum dividit in duo segmenta sive equalia, ut diameter, sive unequalia, ut adiametri. Viriusque igitur segmenti subtensa est. Vt FG non tantum est subtensa arcus FDG, sed etiam arcus reliqui GCIEHBF.

VII. 2. Subtensæ æquales in iisdem aut æqualibus Circulis subtenduntur æqualibus arcibus: inæquales contrà.

VIII. 3. Ut Circulus ad Circulum, sic subtensa arcus ad subtensam arcus alterius similis. Vide p. 7. c. 1.

IX. 4. Inæqualium in eodem Circulo subtensarum diameter est maxima, diametroque propior est major remotiori, remotissima minima.

Hec omnia demonstrantur à Geometricis labore non necessario, siquidem lucem habent naturalem ut è præcedenti schemate manifestum est. Modò in hac comparatione omnes subtensæ sint parallele.

CONSECT. Itaque si quædam sint æquales, æquidistant à centro: & contrà.

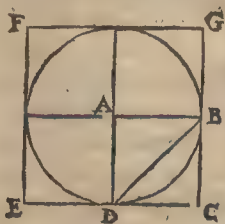
Sic in priori schemate FG & HI quia ponuntur æquales, æquidistant à centro A: & si ponuntur æquidistare à centro, necessariò sunt æquales. Nihil hoc in casu refert, utrum sint parallele vel inclinate: non enim dicitur eas æquidistare à diametro sed à centro.

X. 5. Si subtensa perpendiculariter bisecet subtensam.

subtensam, bisecans diameter est: & contrā si diameter bisecet adiametrum, bisectio perpendicularis est.

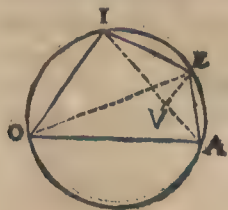
In priori schemate subtensa DE perpendiculariter bisecet subtensam HI: dico bisecantem DE diametrum esse. Bisecetur enim rursus DE perpendiculariter ab alia BC in A. Quoniam igitur segmenta AC, AD, AB, AE sunt æqualia; Circulares radii sunt, adeoque tota BC & DE diametri. Hinc sequitur Conversa: nam quia subtensa quædam perpendiculariter bisecatur inquit nisi diametro, ut jam probatum est, ideoque etiam si diameter quandam aliam bisecat, necesse est perpendiculariter bisecet.

XI. 6 Potentia diametri ad radii potentiam est quadrupla.

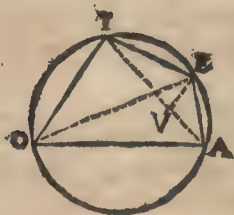


Id quod ad oculum patet in hac figura; ubi  $\square$  tum ABC continetur in  $\square$  to EFGC quater.

XII. 7. Si quatuor in Circulo subtensæ fiant conterminæ, sic ut quadrangulum fortuitum constituât; rectangulum è diagoniis æquatur rectangulis binorum oppositorum laterum simul sumtis.



Sunt subtensæ AE, EI, IO, OA, confluentes quadrangulum quodcunque AEIO, cujus diagoni EO & AI: è quibus factum rectangulum dico æquari duobus rectangulis, quorum alterum



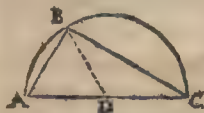
rum ex  $EI$  &  $AO$ , alterum ex  $AE$  &  $IO$  sit factum. Ad  $E$  constitutur angulus  $AEV$  equalis angulo  $OEI$ , quo ipso annulus  $AE O$  equabitur angulo  $IEV$ . Jam Triangula  $AEI$  &  $AEO$  communis baseos in eadem Circuli sectione, quam basis dicta subtendit, uni ad  $I$  &  $O$  equiangula per cons. p. 9. c. 3. Per eandem seriem aequales anguli sunt  $AEO$ , (hoc est,  $VEI$  per structuram) &  $AIO$ . Iam quia in Triangulis  $AEO$  &  $EVI$  angulus  $VEI$  aequatur angulo  $AEO$ , & angulus  $EIV$  angulo  $EOA$ , igitur per p. 11. c. 3. Triangula hec similia sunt, eritq; per p. 13. c. 3. Ut  $EI$  ad  $IV$ , sic  $EO$  ad  $OA$ . Et ita rectangulum ex  $IV$  &  $EO$  aequatur rectangulo ex  $EI$  &  $AO$ . Rursum si subtensa  $EI$  cogitetur Circulum in duas sectiones dividere, erunt per cons. p. 9. c. 3. anguli  $IOE$  &  $IAE$  aequales, & per structuram aequales sunt  $OEI$  &  $AEV$ : ergo per 11. c. 3. Triangula  $AEV$  &  $EOI$  similia sunt, eritque per p. 13. ejusdem, Ut  $EA$  ad  $AV$ , sic  $EO$  ad  $OI$ . Et ita rectangulum ex  $AV$  &  $EO$  aequatur rectangulo ex  $EA$  &  $OI$ . Si igitur per antè demonstrata rectangulum ex  $EO$  &  $IV$  aequatur rectangulo ex  $EI$  &  $AO$ , & per jam demonstrata rectangulum ex  $EO$  &  $VA$  rectangulo ex  $EA$  &  $OI$ ; ergo rectangulū ex  $EO$  & tota  $IA$  aequatur duobus rectangulis, quorum alterum ex  $EI$  &  $AO$ , alterum ex  $AE$  &  $IO$ , simul sumtis; quod erat demonstrandum.

XIII, Sub-

**XIII.** Subtenſæ ſpeciales & limitata ſunt latera quorundam planorum regularium Circulo inſcriptorum.

**XIV.** Latera, inquam, Trianguli, Quadranguli, Sexanguli, Decanguli & Quindecanguli: quorum laterum hæc potentia conſiderantur.

**XV.** Latus Trianguli poteſt triplum Lateris Sexanguli. Latus autem Sexanguli æquatur Radio Circulari.



Primo probandum, latus inſcripti ſexanguli æquale eſſe radio. In præſenti ergo ſit  $AB$  latus ſexanguli, à cuius termino  $B$  ad centrum ducta recta  $BD$  efficit  $\triangle$ lum æquicrurum  $ABD$  (propter æquales radios  $DA$  &  $DB$ ) cuius anguli ad  $A$  &  $B$  per p. 2. c. 3 æquantur. Angulus autem  $D$  opponitur ſextanti peripheria, ex theſi, ac proinde eſt  $60$  gr. & reliqui duo per p. 8. c. 7. junctim ſunt  $120$  gr. Sunt autem ex jammodò demonſtratis æquales: ergo ſinguli  $60$  gr. ut angulus  $D$ . Triangulum itaque  $ABD$  æquiangulum eſt, ideoque per 24. c. 1. Equilaterum. Latus igitur ſexanguli  $AB$  æquatur Radio.

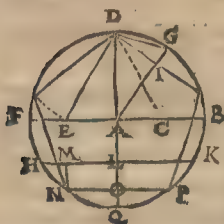
Iam ſecundo latus inſcripti Trianguli  $BC$ , poſſe triplum lateris ſexanguli facilius probatur. Triangulum enim  $ABC$  per p. 16. c. 3. rectangulum eſt ad  $B$ . Proinde per p. 20. ejusdem cap. diameter  $AC$  æquè poteſt lateri ſexanguli  $AB$  ſimul & trianguli  $BC$ . Potentia verd lateris  $AB$  ſive  $AD$  per p. 11. huius c. eſt ad potentiam diametri  $AC$  ſubquadrupla. Ablatâ ergo potentia  $AB$  à ſuo quadruplo relinquitur potentia tripla.

**XVI.** Latus Quadranguli poteſt duplum Radii,



Iterum per p. 20. c. 3. Latus enim quadranguli DB p. 11. h. c. subtendit angulum rectum, igitur æquè potest crucibus AB & AD, quæ cum sint equalia, singulorum potentia subdupla est ad DB.

XVII. Latus Quinquanguli æquè potest Radio & majori segmento radii proportionaliter secti.



Quinquangulum inscribi circulo Geometricè nequit, nisi radio proportionaliter secto. Dicitur autem recta proportionaliter (sive, ut Eucl. loquitur, extrema & mediaratione) secta, cum sicut se habet tota ad segmentum majus, ita segmentum majus ad minus. Sectio perficitur ita: Radius AB bisecatur in C: C connectitur cum alterius radii AD (ad priorem perpendicularis) termino D: rectaq; CD ponitur equalis CE; quo facto radius AF (cui reliqui æquatur) proportionaliter sectus est in E. Ducta verò recta DE est latus inscripti quinquanguli. Quod æquè posse dico radio DA & majori radii segmento AE per p. 20. c. 3. subtendit enim angulum rectum A.

XVIII. Latus Decanguli potest semissem lateris quinquanguli simul & segmentum minus radii latus illud quinquanguli perpendiculariter bisecantis.

Latus Decanguli in prox. pr. Circulo est GD, quod æquè posse dico rectæ DI simul & IG; per p. 20. c. 3. subtendit enim rectum ad I.

XIX. Latus Quindecanguli potest differentiam

rentiam semilaterum trianguli & quinquanguli, simul & segmentum radii dicta latera bisecantis inter utrumq; latus interceptum.

Quindecangulum Circulo inscribitur, inscriptis prius lateribus Quinquanguli  $NP$  & Trianguli  $HK$  parallelis, sient autem parallela si figurae utriusq; vertex statuatur in eodē peripheria puncto  $D$ : tunc enim latus secundum  $\Delta L$  & latus tertium Quinquanguli evadunt parallela. Subtensa  $HN$  inter utriusque figurae latera est latus inscripti quindecanguli. Nam latus Trianguli subtendit peripheria trientem: duo verò quinquanguli latera subtendunt conjunctim duas quintas. Subtractione triente de duabus quintis relinquitur pars peripherie decimaquinta  $HN$ . Hec quia subtendit rectum ad  $M$ , per p. 20. c. 3. aequè potest ipsis  $HM$  &  $MN$ .  $HM$  est differentia inter  $HL$  semilatus  $\Delta i$  &  $NO$  semilatus quinquanguli:  $MN$  aequalis segmento  $LO$  radii  $AQ$  intercepto lateribus supradictis.

XX. Alterum genus inscriptarum Circulo re-  
ctarum sunt Sinus. Sinus est  $\text{recta ab arcus sui ter-}$   
mino in inscriptam perpendicularis.

XXI. Est  $\text{rectus sive primus, vel ver-}$   
sus sive secundus.

XXII. Rectus est  $\text{recta ab arcus sui termino}$   
perpendicularis in diametrum aut radiū Circularē.



In praesenti figura, recta  $EI$  ab  
arcus  $CE$  termino  $E$  perpendicu-  
laris in radium  $AC$  sive diametrum  
 $BC$  est sinus rectus ejusdem arcus  
 $CE$ . Sic  $DI$  est sinus rectus arcus  
 $CD$ :  $EK$  sinus rectus arcus  $FE$ :  
 $GK$  sinus arcus  $FG$ .





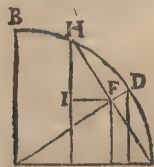




1. Sinus versus arcus quadrante minoris & sinus rectus complementi æquantur radio: sinus versus autem arcus quadrante majoris æquatur radio & sinui recto excessus supra quadrantem.

In cit. pag. 38. figurâ, arcus  $CE$  quadrante minoris sinus versus  $IC$  & sinus rectus  $EK$  hoc est  $IA$  complementi  $EF$ , componunt radium  $AC$ . Arcus autem  $BGF$  sinus versus  $BAI$ , componitur ex radio  $BA$  & recta  $AI$  hoc est  $KE$ , quæ est sinus excessus  $FE$  supra quadrantem  $BGF$ .

XXXI. 2. Sinus rectus & versus æquè possunt arcus sui subtensæ, cujus semissis est sinus rectus arcus subdupli.



Arcus  $HDC$  sinus rectus  $HK$  & *Vide ad* versus  $KC$  æquè possunt subtensæ  $HC$  *calcem trigonometricæ* per p. 20. c. 3.  $\triangle$ lum enim  $HKC$  *hujus subtensæ semissis est.* rectangulum est ad  $K$  per 22. hujus.

XXXII. Sic de rectis Circulo inscriptis: agemus nunc de rectis Circutum Tangentibus & Secantibus.

XXXIII. Tangens hoc loco est recta à secante siue radio per arcus terminum continuato in extremum radii vel diametri perpendicularis.

Aliis etiam dicitur Fœcunda.

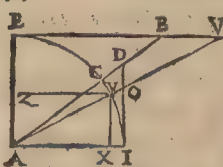
XXXIV. Secans est recta è centro per arcus terminum in tangentem ducta.

Vel est radius ab arcus termino extrâ in tangentem









Vt arcus  $LY$  tangens  $OI$  ad  
 radium  $IA$ , sic radius  $AE$  ad tan-  
 gentem  $EV$  complementi  $EY$ .  
 Triangula enim  $AOI$  &  $AEV$   
 similia sunt propter rectos ad  $E$  &  
 $I$  & propter alternos  $OAI$  &  $A$   
 $VE$  vel etiam  $EAV$  &  $AOI$ .

**XLIII. 4.** Tangentes arcuum sunt tangentibus  
 complementorum reciproce proportionales.

*Vide Manuscripti In proximè preced. figura sicut est IO tangens arcus*  
*correctu van.* **IT** ad  $EV$  tangentem complementi  $TE$ , sic esse dico  $EB$   
 tangentem arcus  $CE$ , complementi scilicet arcus  $IC$ , ad  
 $ID$  tangentem ipsius arcus  $IC$ . Idq̃ propterea, quod per  
 p. præc. radius est medius proportionalis inter tangentem ar-  
 cus & tang. complementi, ita ut oblonga quaelibet è tangente  
 alicujus arcus & tangente complementi facta aequentur  $\square$  to  
 radii per conf. 2. p. 16. c. 2. Adeoque omnia talia oblonga  
 sunt inter se equalia. Oblonga autem equalia sunt lateribus  
 reciproce proportionalia per conf. 3. citate prop.

**XLIV. Secantibus autem :**

1. Ut Sinus arcus est ad radium, sic tangens  
 ad secantem arcus.

Vt  $XT$  ad  $TA$ , sic  $IO$  ad  $OA$  propter causas ad pro-  
 pos. 42. dictas.

**XLV. 2.** Ut sinus ad radium, sic radius ad  
 secantem complementi.

Vt  $YX$  hoc est  $ZA$  ad  $AY$ , sic  $EA$  ad  $AV$  pro-  
 pter easdem causas.

**XLVI. 2.** Ut sinus complementi ad radium,  
 sic radius ad secantem arcus.



quadrantis graduum scrupulorumq; Sinus rectos, Tangentes & Secantes exhibens in partibus radii hypotheticè divisi.

Ptolemæus & veteres tangentium & secantium usum ignorarunt, solis contenti subtensis, & Canonem Triangulorum vocabant eum, qui omnium graduum scrupulorumq; subtensas habebat. Nobis per Tangentes & Secantes calculus in plurimis longè expeditior est. Dicimus autem tabulis hisco contineri Sinus, Tangentes & Secantes singulorum scrup. usque ad quadrantem: non enim extenduntur ultra ob causam p. 36. & conf. l. p. 23. c. ant. indicatam.

*I V.* Sinuum construendorum regulæ sunt istæ.

1. Assumptâ certâ Radii sive Sinus integri mensurâ, si inscripti Trianguli, Quadranguli, Quinquanguli, Sexanguli, Decanguli & Quindecanguli, semilatera in iisdem radii partibus investigentur, ut angulorum quos latera integra subtendunt dimidiorum sinus, & ex his complementorum singulorum semissiumque sinus & contrâ continuè explorentur; tota proximè tabula Sinuum rectorum hac inductione componetur.

Est regula Landspergii, & Finckii. Ante omnia præsupponitur certa radii sive sinus integri mensura & divisio: quæ quò minutiores habet particulas, eò subtilior erit reliquorum Sinuum determinatio. Regiomontanus, qui primus hanc doctrinam studiosissimè prosecutus est, assumpsit radiorum primò particularum 6000000, postea cōmodioris calculi gratia 10000000, Finckius, Landspergius, Maginus, Clavius

Clavius & alii 10000000, Rheticus denique 10000000000. Viginti numeri evaderent precipiosiores, hanc quidem mensuram tabulis inseruerunt, sed ad constructionem antea assumerunt ut plurimum aliquot adhuc cyfras, pro quarum numero ex numeris inventis dexterrimos characteres iterum rejecerunt. Sic Rheticus cum Sinus computare vellet ad partes radii 100000000000, assumpsit Radium particularum 10000000000000000. Nobis cum non novas tabulas extruere, sed extructarum solummodò rationem dare propositum est, radium exempli gratia assumemus particularum 100000. Qualem igitur Sinus totus sive latus inscripti Sexanguli est particularum 100000, talium est latus inscripti Trianguli 173205 proximè. Nam per p. 15. c. 4. est.

A C 200000 ——— □ tum ejus 400000000000.

A B 100000 ——— □ um ejus 100000000000.

Differentia □ ut, 300000000000.

Radix hujus B C 173205. per p. 20. c. 3.

Per eandem & reliquorum planorum latera innotescunt. Itaque latus

scimus. Itaque latus

Trianguli	subtendens	120	erit particularum	173205. per p. 15.	cap. præcedent.
Quadianguli		90		141422. per	16.
Quinquanguli		72		117557. per	17.
Sexanguli		60		100000. per	15.
Decanguli		36		61803. per	18.
Quindecanguli		24		41582. per	19.

Ultimum hoc quomodo peruestigetur, p. 19. c. præc. non potuit explicari ante explicatos sinus. Ergo sic proceditur: In Circulo p. 17. dantur arcuum QH, QN Sinus tunc recti HL & NO tum versi LQ & OQ. Differentia sinuum rectorum est HM, versorum LO sive MN. His duabus HM & MN æquè potest latus quindecanguli HN, ut ibi probatum est.

Ex horum



36603. Sinus graduum 60. Ex horum arcuum sinibus, qui propter-  
 70711. 45. ea Sinus primarii dicuntur, omnium ferme  
 58779. 36. arcuum reliquorum Sinus eruuntur, si con-  
 50000. 30. tinuè complementorum semissimumq; Sinus  
 30902. 18. determinentur, & contrà. Exemplum assu-  
 20791. Sinus 12. manus cum Landspergio ultimum, Arcum  
 scilicet gr. 12. cum suo sinu 20791. Hujus arcus

	6	0	10453.	84	0	99452.
Cōtinua	3	0	5234.	87	0	99863.
semisses	1	30	2618.	88	30	99966.
	0	45	1309.	89	15	99991.
			Sinus earum			Sinus eor.

Sic singulorum denuò semisses harumque comple-  
 menta explorentur.

Ceterum sinus complementi investigatur per p. 26. c.  
 4. Sinus arcus dimidui per 31. Sinus arcus dupli per 27.

V. 2. Duorum arcuum pariter hincinde à 60  
 gr. distantium sinus produnt sinum distantie, vel  
 hic alterutrum illorum, sola subtractione.

Non sint si aut arcuum 52 gr. 30 m. & 67 gr. 30 m.  
 alter Sextante minor & alter major est gr. 7. 30 m. Si-  
 nus minoris 79335 subtractus à sinu majoris 92388 re-  
 linquit 13053 sinum distantie 7 gr. 30 m. per 28. c. 4.  
 Sic etiam si sinum distantie subtrahas à sinu alterutrius ar-  
 cus, prodit sinus alterius.

VI. 3. Si duorum arcuum inæqualium con-  
 junctim quadrante minorum sinus ducantur al-  
 ternatim in sinus suorum complementorum,  
 productorum summa per radium divisa profert  
 sinum summæ arcuum; productorum autem  
 differentia sic divisa profert sinum differentie  
 arcuum

arcuum eorundem: si ducantur sinus arcuum in sinus arcuum, & sinus complementorum in sinus complementorum; productorum summa per radium divisa profert sinum complementi differentie arcuum; productorum autem differentia sic divisa profert sinum complementi summe eorundem arcuum.

Per p. 12. c. 4. Quæ etsi per subiensas hoc demonstrat, tamen id ad sinus recte accommodatur: nam ut totum ad totum, sic semissis ad semissim. Id saltem noteatur, unam ibi diagonalium hac in praxi fieri diametrum. Exempla sunt in Fincheo & Pirisco.

VII. 4. Sinus primi & ultimi gradus cum suorum scrupulorum finibus non nisi proportionaliter è gradus dodrante & ejus duplo colligi possunt.

Continuâ bisectione arcuum è semilateribus figurarum regularium superiori modo factâ nunquam pervenitur ad gradum unum aut gradus 89 absolutè. Alio igitur modo horum graduum eorumq. scrupulorum sinus investigantur. Nimirum supra videmus 1. gr. 30 scr. sinum 2618, ad 0 gr. 45 scr. sinum 1309 præcisè subduplum, hoc est, eadem proportionem, ut ipsos arcus: aded ut propter exilitatem linearum hic jam nulla sentiat differentia linea recta à Circulari. Proinde si primò ad sinum scr. 45 adjicias ejusdem sinus irientem, nempe 436, produciatur sinus unius gradus integri 1745; si eundem irientem subtrahas, relinquitur 873 sinus dimidii gradus. Hujus pars tricesima vel de sinu integri gradus pars sexagesima, est sinus unius scrupuli. Unde scrupulorum reliquorum sinus ut & sinus complementorum supputantur.

*VIII. Sinuum versorum tabula non solet construi: siquidem omnes & singuli solâ prosthaphæresi colliguntur.*

Maginus Canoni suo Mathematico sinus versos addidit. Non autem opus esset peculiari tabulâ: Sinus enim versus arcus quadrante minoris, aut anguli acuti, est Radius & sinus complementi differentia. Arcus autem quadrante majoris, aut anguli obtusi, Sinus versus est Radius & Sinus Excessus aggregatum, per propof. 30. c. 4. Exempli gratia infra p. 14. c. 7. dabitur arcus 45 grad. 6 min. cui querendus sinus versus: Sinus complementi est 70587, qui subtractus à 100000 relinquit sinum versum quaesitum 29413. Ibidem dabuntur & 108 gr. 45 min. Excessus supra quadrantem 18 gr. 45 min. sinus rectus 32144 additus sinui toti 100000 producit 132141 sinum versum 108 gr. 45 min. Contrâ si datur sinus versus, & queratur respondens arcus aut angulus, præcognitum requiritur, utrum sinus iste versus Radio minor sit an major. Si minor; à radio subtractus relinquit sinum rectum complementi arcus aut anguli quaesiti. Sin major; ab eo subtractus radius relinquit sinum rectum excessus quaesiti arcus aut anguli supra quadrantem.

*IX. Tangentium supputandarum regula generalis est hæc una:*

Si singuli totius quadrantis sinus recti ducantur in radium, & producta per sinus complementorum dividantur; Quotientes tabulam Tangentium componunt.

*Per*

## CAP. V.

Cap. VI. in tabula

Per p. 41. c. præced. Tabula Tangentium Reinholdo  
vocatur Fœcunda: Rhetico Canon basis & perpendiculari se-  
cundus: Adr. Romano Canon Prosinuum.

### X. Secantium itidem una:

Quadratum Radii per singulos comple-  
mentorum sinus divisum componit totam ta-  
bulam Secantium.

Per 46 ejusdem c. Tabula Secantium aliis vocatur Be-  
nesica: Rhetico Canon hypotenusarum: Romano Canon  
Transsinuosarum.

### XI. Veriusque <sup>compendia</sup> communia sunt:

1. Tangens arcus addita tangenti semicom-  
plementi componit arcus dicti Secantem: tan-  
gentis autem & secantis ejusdem arcus diffe-  
rentia est tangens semicomplementi. Per 38 c. 4.

XII. 2. Tangens & Secans ejusdem arcus  
componunt tangentem arcus è priori & ejus  
semicomplemento compositi: Differentia  
verò tangentium dati arcus & semicomple-  
menti est arcus dati Secans.

Per 39. c. 4. Et hac in universum est methodus con-  
structi Canonis Triangulorum. Constructionis calculum ali-  
quot exemplis illustraremus, nisi prelixitatem stu-  
diis evitarem. Qui talibus exercitiis delectantur, adeant Finck-  
um, Landspergium, Pitiscum, Rheticum: aut etiam è  
sequentibus tabulis periculum facere poterunt.

### XIII. Canon ita nobis dispositus est, ut

1. In vertice marginis sinistri contineat gra-  
dus.



duſ cum ſcrupulis inde deſcendentibus, & in baſi marginis dextri, gradus cum ſcrupulis inde aſcendentibus: dextra verò ſcrupula per paginam tranſverſam ſiniſtris, vel hæc illis oppoſita, cum convenientibus gradibus ſunt mutua ſibi ad quadrantem complementa.

In fronte tabularum, & quidem in vertice marginis ſiniſtri, reperiuntur ordine gradus uſque ad ſemiquadrantem, minutis adhaerentibus in eodem margine deſcendentibus: in te ordine foliorum retrogrado gradus à quadrageſimo quinto ad 90 exhibentur in baſi marginis dextri, minutis eorum in eodem margine aſcendentibus. Quod ſi detur certus arcus aliquot graduum & minutorum, & is reperiatur ſuperius; ex gradu in eadem pagina infera & minuto minutis datis tranſverſaliter oppoſito colligitur arcus complementi. Sic etiam ſi gradus datus reperiatur infra, gradus ſuperior cum minutis tranſverſaliter oppoſitis minuta dato, determinat complementum. Vt arcus  $15^{\circ} 46'$  complementum eſt  $74^{\circ} 14'$  & contrà.

XIV. 2. Singulæ titulorum ſive Canonicoꝝ Numerorum columnæ biſſæ ſunt; ita ut fiſſura ſiniſtra cõtineat numeros ad gradum ſuperum & ſcrupula marginis ſiniſtri; fiſſura verò dextra numeros ad gradum inferum & ſcrupula marginis dextri pertinentes.

Ex hiſ intelligitur modus excerpendorum numerorum Canonicoꝝ. Exempli gratia detur arcus  $26^{\circ} 23'$  cuius querendus Sinus, Tangens, Secans. Gradus hic quia ſemiquadrantem non explet, ſuperius queritur, & ſub eo deſcen-

descendendo scrupula 23. hinc transversaliter in fissuris columellarum sinistris respondent Sinus 44437, Tangens 49604, Secans 111627. Sindetur arcus 54 gr. 34 m. gradus quarumvis inferius, & ab eo ascendendo scrup. 34, quibus transversaliter in fissuris columellarum dextris respondent Sinus 81479, Tangens 140540, Secans 172487.

Contra si detur Sinus aliquis, vel Tangens, vel Secans, tam diu in area tabula quaeritur, donec suo loco repertus in convenienti margine indicat gradum & scrupula respondentia.

XV. 3. Quia verò, posito nobis Radio partium 100000, sinus duorum ultimorum & secantes duorum primorum quadrantis graduum non semper exactè respondentia monstrare valent scrupula; absoluto Canoni subjunximus binorum graduum sinus & secantes ad particulas Radii 10000000.

Vide declarationem (forte sic iubente) in fine Opusculi.

XVI. Si scrupulis primis adhæreant etiam secunda; differentia Canonorum numerorum scrupulo primo dato & proximè sequenti competentium per adhærentia secunda multiplicetur: producto per 60 diviso Quotiens exhibet partem proportionalem numero Canonico dati scrup. primi addendam, ut prodeat numerus integer quæsitus.

Ita si datus Numerus in tabulis præcisè non inveniatur; differentia numeri dati & proximè in tabula minoris per 60 multiplicetur: producto per differentiam numerorum proximè minoris & majoris diviso, Quotiens exhibet scrupp. proportionalia secunda, scrupulis primis minori numero respondentibus addenda, ut prodeat arcus integer quæsitus.

Rheticus & Valentinus Orho in grandi illo Opere Palatino Canonem suum totum ad decades scrup. secundorum extenderunt. Reliqui autores contenti sunt scrup. primis, ita tamen ut secunda proportionaliter è primis derivare possint. Exempli gratia detur arcus 34 gr. 17 min. 14. secund. cujus querendus sinus. Sinus 34 gr. & 17 min. in tabulis reperitur 56329, scrupuli proximè sequentis Sinus 56353: differentia 24. Jam collige: si 60 scrup. secunda addunt 24, ergo 14 secunda addunt paulò plus 5. Ergo sinus quæsitus est 56335 ferè. Contrà detur hic sinus ei9, sic querendus respondens arcus. Sinus proximè minor reperitur 56329, proximè major 56353; differentia 24: differentia sinus dati & proximè minoris 6. Jam collige: si 24 respondent 60 secundis, ergo 6 respondent paulò plus 14 sec. Igitur arcus sinui dato 56335 respondens est 34 gr. 17. m. 14 sec.

XVII. Examen constructi Canonis aut per regulas sit antè traditas, aut per differentias proximorum numerorum Canonicorum primas & secundas sive primarum vicinarum differentias:

Vira-

*V. raque enim differentia proportionaliter crescunt ac decrescunt. Ultimus tamen earum character unitate esse indifferens.*

Herculeum est in tanto numerorum numero evitare *sphalmata*: quæ tamen à nonnullis Trigonometria scriptoribus magno cum Logista detrimento dissimulantur. Quandoque igitur in eorum tabulas incideris, vide te falsum precipitanter arripias pro vero. Ac primis quidem ad sinistram characteribus duobus, interdum etiam tribus, si quis error insit, facile deprehenditur. Exempli gratia, in notis tabulis inter Secantes scrupulorum à 30 ad 60, gradus 84, ad scrup. 42 irrepserat Secans 1982596, cum tamen aliquot præcedentium & subsequentium characteres priores sint 108 & 107: itaque & dicta Secans debet esse 1082 &c. Sic Secans 80 grad. 18. min. erat 563509 cum tamen ex aspectu vicinorum colligatur 593509. De reliquis autem alicujus Numeri Canonici characteribus si fortè dubites, inquire tum numeri propositi cum præcedente & sequente, tum aliquot vicinorum differentias: quæ si fuerint æquales, aut proportionaliter crescant vel decrescant; nullum subest vitium. An verò proportionaliter crescant vel decrescant, differentiarum differentia, quas differentias secundas dicunt, indicant. Exempli gratia, Tangens 12 gr. 52 min. in tabulis erat 22812 à proximè præcedente tantum unitate, à seq. verò sexagenario differens: igitur falsa & sic emendata:

Tan.



Tang. Diff.

12	49	22750	31	Vides differentiam ubiq <sup>ue</sup> esse debere aut 30 aut 31. igitur
12	50	22781	30	
12	51	22811	1	Tangens 12 gr. 52 m. emen- data est 22842.
12	52	22812	60	
12	53	22872	31	
12	54	22903		

Sic Tangens 78 gr. 58 min. erat 125682, quæ falsa  
deprehenditur, hoc modo:

		Tangens	Diff. I.	Diff. II.
78	54	509704	786	
78	55	510490	789	3 exc.
78	56	511279	790	1 exc.
78	57	512069	613	187 def.
78	58	512682	976	363 exc.
78	59	513658	797	179 def.
79	0	514455	801	4 exc.
79	1	515256		

Vides disconvenientiam differentiarum secundarum  
287. 363. 179. quarum prima & tertia est differentia  
defectus, media contra excessus: cum tamen semper se-  
quens differentia prima antecedenti vel equalis vel major  
esse debeat. E differentiis autem primis colligitur, differen-  
tias secundas hoc loco esse debere 2. 3. 4. ergo ad differen-  
tiam primam 790 addita 3 producunt 793 & non 613:  
Atque ita differentia rima 793 addita tangenti 512069  
producit 512862 tangentem emendatam.

Verum quod in præfatione hujus Tractatus feci, hic  
denuò Logistam jubeo viciorum in tabulis nostris commisso-  
rum esse securum: audacter illis vitior, erratis, quæ calcu-  
lum turbare possint, studiosè correctis. Saltem si, quod fieri  
solet, in quibusdam exemplaribus atramentum typographi-  
cum quosdam numeros fortè non satis expressisset, judicium  
de dubiis ferat è vicinorum differentiis inter se collatis,  
ut monstratum est.

CANON

CANON  
TRIANGULORUM

Sive

T A B U L Æ

SINUUM

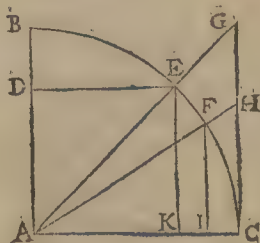
# TANGENTIUM

ET

SE CANT IUM

Ad partes Radii 100000;

& ad scrupula prima  
Quadrantis,



DANTISCI

Typis Hünefeldianis

Anno 1612.

# T A B U L Æ

Sinuum			Tangētium		Secantium		
o			o	Infinitum	o	Infinitum	
1	29	100000	29	343760708	100000	343760723	59
2	58	99999	58	171880337	100000	171880366	58
3	87	99999	87	114586868	100000	114586912	57
4	116	99999	116	85940125	100000	85940184	56
5	145	99999	145	68756800	100000	68756873	55
6	175	99999	175	57296338	100000	57296426	54
7	204	99999	204	49112455	100000	4911256	53
8	233	99999	233	42971819	100000	42971935	52
9	262	99999	262	38196963	100000	38197094	51
10	291	99999	291	34378290	100000	34378435	50
11	320	99999	320	31252767	100001	31252827	49
12	349	99999	349	28648192	100001	28648347	48
13	378	99999	378	26444340	100001	26444509	47
14	407	99999	407	24555338	100001	24555542	46
15	436	99999	436	22918739	100001	22918957	45
16	465	99999	465	21486197	100001	21486430	44
17	495	99999	495	20222198	100001	20222345	43
18	524	99999	524	19098650	100001	19098911	42
19	553	99998	553	18093374	100002	18093650	41
20	582	99998	582	17188631	100002	17188922	40
21	611	99998	611	16370057	100002	16370362	39
22	640	99998	640	15625900	100002	15626220	38
23	669	99998	669	14946455	100002	14946789	37
24	698	99998	698	14323630	100002	14323979	36
25	727	99997	727	13750822	100003	13751185	35
26	756	99997	756	13221887	100003	13222265	34
27	785	99997	785	12732134	100003	12732527	33
28	814	99997	815	12277365	100003	12277772	32
29	844	99996	844	11853959	100004	11854381	31
30	873	99996	873	11458911	100004	11459348	30

# T A B U L Æ

Sinuum		Tangētium		Secantium		
30	873 99996	873	11458911	100004	11459348	30
31	902 99996	902	11089221	100004	11089672	29
32	931 99996	931	10742634	100004	10743099	28
33	960 99995	960	10417055	100005	10417534	27
34	989 99995	989	10110627	100005	10111121	26
35	1018 99995	1018	9821806	100005	9822315	25
36	1047 99995	1047	9548933	100005	9549457	24
37	1076 99994	1076	9290811	100006	9291349	23
38	1105 99994	1105	9046274	100006	9046826	22
39	1134 99994	1134	8814277	100006	8814844	21
40	1164 99993	1164	8593954	100007	8594536	20
41	1193 99993	1193	8384304	100007	8384901	19
42	1222 99993	1222	8184638	100007	8185249	18
43	1251 99992	1251	7994322	100008	7994947	17
44	1280 99992	1280	7812593	100008	7813233	16
45	1309 99991	1309	7638998	100009	7639653	15
46	1338 99991	1338	7472893	100009	7473562	14
47	1367 99991	1367	7313856	100009	7314540	13
48	1396 99990	1396	7161497	100010	7162295	12
49	1425 99990	1425	7015315	100010	7016127	11
50	1454 99989	1455	6875007	100011	6875735	10
51	1483 99989	1484	6740164	100011	6740905	9
52	1513 99989	1513	6610507	100011	6611264	8
53	1542 99988	1542	6485785	100012	6486556	7
54	1571 99988	1571	6365649	100012	6366426	6
55	1600 99987	1600	6249903	100013	6250703	5
56	1629 99987	1629	6138260	100013	6139074	4
57	1658 99986	1658	6030570	100014	6031399	3
58	1687 99986	1687	5926557	100014	5927401	2
59	1716 99985	1716	5826104	100015	5826962	1
60	1745 99985	1745	5728998	100015	5729871	0



# TABULÆ

	Sinuum		Tangētium		Secantium		
0	1745	99985	1745	5728998	100015	5729871	60
1	1774	99984	1775	5635043	100016	5635930	59
2	1803	99984	1804	5544149	100016	5545051	58
3	1832	99983	1833	5456130	100017	5457026	57
4	1862	99983	1862	5370850	100017	5371781	56
5	1891	99982	1891	5288213	100018	5289158	55
6	1920	99982	1920	5208052	100018	5209012	54
7	1949	99981	1949	5130309	100019	5131284	53
8	1978	99980	1978	5054827	100020	5055816	52
9	2007	99980	2007	4981558	100020	4982561	51
10	2036	99979	2036	4910380	100021	4911398	50
11	2065	99979	2066	4841184	100021	4842216	49
12	2094	99978	2095	4773932	100022	4774978	48
13	2123	99977	2124	4708522	100023	4709583	47
14	2152	99977	2153	4644879	100023	4645955	46
15	2181	99976	2182	4582932	100024	4584023	45
16	2211	99976	2211	4522615	100024	4523720	44
17	2240	99975	2240	4463863	100025	4464983	43
18	2269	99974	2269	4406618	100026	4407752	42
19	2298	99974	2298	4350821	100026	4351970	41
20	2327	99973	2328	4296418	100027	4297582	40
21	2356	99972	2357	4243358	100028	4244536	39
22	2385	99972	2386	4191591	100028	4192784	38
23	2414	99971	2415	4141070	100029	4142279	37
24	2443	99970	2444	4091754	100030	4093976	36
25	2472	99969	2473	4043596	100031	4044833	35
26	2501	99969	2502	3995558	100031	3997809	34
27	2530	99968	2531	3950601	100032	3951866	33
28	2560	99967	2560	3905687	100033	3906967	32
29	2589	99966	2589	3861783	100034	3863077	31
30	2618	99966	2619	3818853	100034	3820162	30

# T A B U L Æ

	Sinuum		Tangētium		Secanti v m		
30	2618	99966	2619	3818853	100034	3820162	30
31	2647	99965	2648	3776866	100035	3778190	29
32	2676	99964	2677	3735792	100036	3737130	28
33	2705	99963	2706	3695601	100037	3696953	27
34	2734	99963	2735	3656264	100037	3657631	26
35	2763	99962	2764	3617768	100038	3619150	25
36	2792	99961	2793	3580060	100039	3581457	24
37	2821	99960	2822	3543130	100040	3544541	23
38	2850	99959	2851	3506953	100041	3508378	22
39	2879	99959	2881	3471506	100041	3472946	21
40	2908	99958	2910	3436779	100042	3438234	20
41	2938	99957	2939	3402727	100043	3404197	19
42	2967	99956	2968	3369345	100044	3370828	18
43	2996	99955	2997	3336620	100045	3338118	17
44	3025	99954	3026	3304513	100046	3306025	16
45	3054	99953	3055	3273028	100047	3274555	15
46	3083	99952	3084	3242126	100048	3243668	14
47	3112	99952	3114	3211811	100048	3213368	13
48	3141	99951	3143	3182048	100049	3183618	12
49	3170	99950	3172	3152839	100050	3154425	11
50	3199	99949	3201	3124162	100051	3125762	10
51	3228	99948	3230	3095991	100052	3097605	9
52	3257	99947	3259	3068332	100053	3069961	8
53	3286	99946	3288	3041158	100054	3042797	7
54	3316	99945	3317	3014460	100055	3016118	6
55	3345	99944	3346	2988230	100056	2989903	5
56	3374	99943	3376	2962444	100057	2964131	4
57	3403	99942	3405	2937106	100058	2938807	3
58	3432	99941	3434	2912198	100059	2913914	2
59	3461	99940	3463	2887707	100060	2889438	1
60	3490	99939	3492	2863625	100061	2865370	0

# TABULÆ

2	Sinuum		Tangētium		Secantium		
0	3490	99939	3492	2863625	100061	2865370	60
1	3519	99938	3521	2839940	100062	2841700	59
2	3548	99937	3550	2816643	100063	2818418	58
3	3577	99936	3579	2793724	100064	2795513	57
4	3606	99935	3609	2771175	100065	2772980	56
5	3635	99934	3638	2748986	100066	2750805	55
6	3664	99933	3667	2727149	100067	2728982	54
7	3693	99932	3696	2705656	100068	2707503	53
8	3723	99931	3725	2684498	100069	2686359	52
9	3752	99930	3754	2663667	100070	2665543	51
10	3781	99929	3783	2643164	100072	2645055	50
11	3810	99927	3812	2622966	100073	2624872	49
12	3839	99926	3842	2603074	100074	2604994	48
13	3868	99925	3871	2583481	100075	2585416	47
14	3897	99924	3900	2564180	100076	2566129	46
15	3926	99923	3929	2545171	100077	2547135	45
16	3955	99922	3958	2526435	100078	2528413	44
17	3984	99921	3987	2507972	100079	2509964	43
18	4013	99919	4016	2489782	100081	2491790	42
19	4042	99918	4046	2471848	100082	2473870	41
20	4071	99917	4075	2454175	100083	2456212	40
21	4100	99916	4104	2436747	100084	2438798	39
22	4129	99915	4133	2419577	100085	2421636	38
23	4159	99913	4162	2402627	100087	2404707	37
24	4188	99912	4191	2385925	100088	2388020	36
25	4217	99911	4220	2369453	100089	2371562	35
26	4246	99910	4250	2353209	100090	2355324	34
27	4275	99909	4279	2337174	100091	2339313	33
28	4304	99907	4308	2321364	100093	2323517	32
29	4333	99906	4337	2305766	100094	2307934	31
30	4362	99905	4366	2290376	100095	2292558	30

# T A B U L Æ

2	Sinuum		Tangētium		Secantium		
30	4362	99905	4366	2290376	100095	2292558	30
31	4391	99904	4395	2275189	100097	2277386	29
32	4420	99902	4424	2260202	100098	2262413	28
33	4449	99901	4454	2245410	100099	2247635	27
34	4478	99900	4483	2230810	100100	2233050	26
35	4507	99898	4512	2216398	100102	2218653	25
36	4536	99897	4541	2202170	100103	2204440	24
37	4565	99896	4570	2188124	100104	2190409	23
38	4594	99894	4599	2174255	100106	2176553	22
39	4623	99893	4628	2160560	100107	2162873	21
40	4653	99892	4658	2147041	100108	2149368	20
41	4682	99890	4687	2133682	100110	2136024	19
42	4711	99889	4716	2120493	100111	2122849	18
43	4740	99888	4745	2107467	100113	2109838	17
44	4769	99886	4774	2094595	100114	2096981	16
45	4798	99885	4803	2081884	100115	2084284	15
46	4827	99883	4833	2069321	100117	2071736	14
47	4856	99882	4862	2056913	100118	2059342	13
48	4885	99881	4891	2044647	100120	2047091	12
49	4914	99879	4920	2032531	100121	2034989	11
50	4943	99878	4949	2020557	100122	2023030	10
51	4972	99876	4978	2008719	100124	2011206	9
52	5001	99875	5007	1997022	100125	1999524	8
53	5030	99873	5037	1985460	100127	1987977	7
54	5059	99872	5066	1974031	100128	1976562	6
55	5088	99870	5095	1962731	100130	1965277	5
56	5117	99869	5124	1951557	100131	1954117	4
57	5146	99867	5153	1940512	100133	1943087	3
58	5175	99866	5182	1929591	100134	1932180	2
59	5205	99864	5212	1918792	100136	1921396	1
60	5234	99863	5241	1908112	100137	1910731	0



# T A B U L Æ

3	Sinuum		Tangētium		Secantium		
0	5234	99863	5241	1908112	100137	1910731	60
1	5263	99861	5270	1897550	100139	1900183	59
2	5292	99860	5299	1887104	100140	1889752	58
3	5321	99858	5328	1876773	100142	1879434	57
4	5350	99857	5357	1866552	100143	1869229	56
5	5379	99855	5387	1856446	100145	1859137	55
6	5408	99854	5416	1846444	100147	1849150	54
7	5437	99852	5445	1836549	100148	1839270	53
8	5466	99850	5474	1826763	100150	1829498	52
9	5495	99849	5503	1817077	100151	1819826	51
10	5524	99847	5533	1807495	100153	1810260	50
11	5553	99846	5562	1798011	100155	1800790	49
12	5582	99844	5591	1788628	100156	1791421	48
13	5611	99842	5620	1779342	100158	1782150	47
14	5640	99841	5649	1770152	100159	1772974	46
15	5669	99839	5678	1761056	100161	1763892	45
16	5698	99838	5708	1752052	100163	1754903	44
17	5727	99836	5737	1743139	100164	1746005	43
18	5756	99834	5766	1734316	100166	1737197	42
19	5785	99833	5795	1725582	100168	1728477	41
20	5814	99831	5824	1716935	100169	1719844	40
21	5844	99829	5854	1708374	100171	1711298	39
22	5873	99827	5883	1699896	100173	1702835	38
23	5902	99826	5912	1691502	100175	1694456	37
24	5931	99824	5941	1683191	100176	1686159	36
25	5960	99822	5970	1674963	100178	1677945	35
26	5989	99821	5999	1666812	100180	1669809	34
27	6018	99819	6029	1658739	100182	1661751	33
28	6047	99817	6058	1650747	100183	1653773	32
29	6076	99815	6087	1642828	10018	1645868	31
30	6105	99813	6116	1634987	10018	1638042	30

# T A B U L Æ

3	Sinuum		Tangētium		Secantium		
30	6105	99813	6116	1634987	100187	1638042	30
31	6134	99812	6145	1627217	100184	1630287	29
32	6163	99810	6175	1619523	100190	1622607	28
33	6192	99808	6204	1611898	100192	1614997	27
34	6221	99806	6233	1604348	100194	1607461	26
35	6250	99804	6262	1596868	100196	1599996	25
36	6279	99803	6291	1589455	100198	1592598	24
37	6308	99801	6321	1582111	100200	1585269	23
38	6337	99799	6350	1574835	100201	1578006	22
39	6366	99797	6379	1567624	100203	1570811	21
40	6395	99795	6408	1560479	100205	1563689	20
41	6424	99793	6437	1553399	100207	1556614	19
42	6453	99792	6467	1546382	100209	1549612	18
43	6482	99790	6496	1539427	100211	1542672	17
44	6511	99788	6525	1532535	100213	1535795	16
45	6540	99786	6554	1525706	100215	1528979	15
46	6569	99784	6584	1518935	100216	1522223	14
47	6598	99782	6613	1512223	100218	1515526	13
48	6627	99780	6642	1505572	100220	1508890	12
49	6656	99778	6671	1498978	100222	1502309	11
50	6685	99776	6700	1492441	100224	1495788	10
51	6714	99774	6730	1485960	100226	1489321	9
52	6743	99772	6759	1479536	100228	1482912	8
53	6773	99770	6788	1473167	100230	1476557	7
54	6802	99768	6817	1466853	100232	1470257	6
55	6831	99766	6847	1460592	100234	1464011	5
56	6860	99764	6876	1454384	100236	1457817	4
57	6889	99762	6905	1448228	100238	1451676	3
58	6918	99760	6934	1442123	100240	1445586	2
59	6947	99758	6963	1436069	100242	1439547	1
60	6976	99756	6993	1430066	100244	1433558	0

# T A B U L Æ

4	Sinuum		Tangētium		Secantium		
0	6976	99756	6993	1430066	100244	1433558	60
1	7005	99754	7022	1424112	100246	1427619	59
2	7034	99752	7051	1418208	100248	1421729	58
3	7063	99750	7080	1412353	100250	1415889	57
4	7092	99748	7110	1406545	100252	1410095	56
5	7121	99746	7139	1400785	100254	1404350	55
6	7150	99744	7168	1395071	100257	1398650	54
7	7179	99742	7197	1389404	100259	1392998	53
8	7208	99740	7227	1383783	100261	1387392	52
9	7237	99738	7256	1378207	100263	1381830	51
10	7266	99736	7285	1372675	100265	1376312	50
11	7295	99734	7314	1367187	100267	1370839	49
12	7324	99731	7344	1361743	100269	1365410	48
13	7353	99729	7373	1356341	100271	1360026	47
14	7382	99727	7402	1350982	100274	1354677	46
15	7411	99725	7431	1345664	100276	1349375	45
16	7440	99723	7461	1340388	100278	1344113	44
17	7469	99721	7490	1335156	100280	1338896	43
18	7498	99719	7519	1329958	100282	1333714	42
19	7527	99716	7548	1324803	100284	1328572	41
20	7556	99714	7578	1319689	100287	1323473	40
21	7585	99712	7607	1314613	100289	1318411	39
22	7614	99710	7636	1309577	100291	1313389	38
23	7643	99708	7665	1304577	100293	1308404	37
24	7672	99705	7695	1299617	100296	1303458	36
25	7701	99703	7724	1294693	100298	1298549	35
26	7730	99701	7753	1289805	100300	1293676	34
27	7759	99699	7782	1284955	100302	1288841	33
28	7788	99696	7812	1280142	100305	1284042	32
29	7817	99694	7841	1275363	100307	1279278	31
30	7846	99692	7870	1270620	100309	1274549	30

# T A B U L Æ

4	Sinuum		Tangētium		Secantium		
30	7846	99692	7870	1270620	100309	1274549	30
31	7875	99689	7899	1265912	100311	1269856	29
32	7904	99687	7929	1261238	100314	1265197	28
33	7933	99685	7958	1256599	100316	1260571	27
34	7962	99683	7987	1251993	100318	1255980	26
35	7991	99680	8017	1247422	100321	1251424	25
36	8020	99678	8046	1242882	100323	1246898	24
37	8049	99676	8075	1238376	100325	1242407	23
38	8078	99673	8104	1233901	100328	1237947	22
39	8107	99671	8134	1229460	100330	1233520	21
40	8136	99668	8163	1225050	100333	1229125	20
41	8165	99666	8192	1220672	100335	1224761	19
42	8194	99664	8221	1216324	100337	1220428	18
43	8223	99661	8251	1212006	100340	1216125	17
44	8252	99659	8280	1207719	100342	1211852	16
45	8281	99657	8309	1203462	100345	1207610	15
46	8310	99654	8339	1199235	100347	1203397	14
47	8339	99652	8368	1195037	100350	1199213	13
48	8368	99649	8397	1190869	100352	1195060	12
49	8397	99647	8427	1186728	100354	1190934	11
50	8426	99644	8456	1182618	100357	1186838	10
51	8455	99642	8485	1178533	100359	1182768	9
52	8484	99639	8514	1174479	100362	1178728	8
53	8513	99637	8544	1170450	100364	1174714	7
54	8542	99635	8573	1166450	100367	1170729	6
55	8571	99632	8602	1162477	100369	1166770	5
56	8600	99630	8632	1158530	100372	1162838	4
57	8629	99627	8661	1154610	100374	1158932	3
58	8658	99625	8690	1150716	100377	1155053	2
59	8687	99622	8720	1146848	100379	1151200	1
60	8716	99619	8749	1143006	100382	1147372	0



# TABULÆ

5	Sinum	Tangētium	Secantium	
0	8716 99619	8749 1143006	100382 1147372	60
1	8745 99617	8778 1139189	100385 1143569	59
2	8774 99614	8807 1135397	100387 1139792	58
3	8802 99612	8837 1131631	100390 1136040	57
4	8831 99609	8866 1127889	100392 1132313	56
5	8860 99607	8895 1124172	100395 1128611	55
6	8889 99604	8925 1120478	100397 1124932	54
7	8918 99602	8954 1116809	100400 1121277	53
8	8947 99599	8983 1113164	100403 1117647	52
9	8976 99596	9013 1109543	100405 1114040	51
10	9005 99594	9042 1105944	100408 1110456	50
11	9034 99591	9071 1102369	100411 1106895	49
12	9063 99588	9101 1098816	100413 1103357	48
13	9092 99586	9130 1095286	100416 1099841	47
14	9121 99583	9159 1091778	100419 1096348	46
15	9150 99580	9189 1088292	100421 1092877	45
16	9179 99578	9218 1084829	100424 1089428	44
17	9208 99575	9247 1081388	100427 1086001	43
18	9237 99572	9277 1077967	100429 1082596	42
19	9266 99570	9306 1074569	100432 1079212	41
20	9295 99567	9335 1071192	100435 1075850	40
21	9324 99564	9365 1067835	100438 1072507	39
22	9353 99562	9394 1064499	100440 1069186	38
23	9382 99559	9423 1061184	100443 1065886	37
24	9411 99556	9453 1057890	100446 1062606	36
25	9440 99553	9482 1054615	100449 1059346	35
26	9469 99551	9511 1051361	100451 1056106	34
27	9498 99548	9541 1048126	100454 1052885	33
28	9527 99545	9570 1044911	100457 1049685	32
29	9556 99542	9600 1041715	100460 1046503	31
30	9585 99540	9629 1038539	100463 1043343	30

# T A B U L Æ

5	Sinuum		Tangentium		Secantium		
30	9585	99540	9619	1038539	100463	1043343	30
31	9614	99537	9658	1035382	100465	1040200	29
32	9642	99534	9688	1032244	100468	1037077	28
33	9671	99531	9717	1029125	100471	1033972	27
34	9700	99528	9746	1026025	100474	1030886	26
35	9729	99526	9776	1022943	100477	1027819	25
36	9758	99523	9805	1019879	100480	1024770	24
37	9787	99520	9834	1016833	100482	1021739	23
38	9816	99517	9864	1013805	100485	1018725	22
39	9845	99514	9893	1010795	100488	1015730	21
40	9874	99511	9923	1007803	100491	1012753	20
41	9903	99508	9952	1004828	100494	1009792	19
42	9932	99506	9981	1001870	100497	1006849	18
43	9961	99503	10011	998930	100500	1003923	17
44	9990	99500	10040	996007	100503	1001014	16
45	10019	99497	10069	993100	100506	998123	15
46	10048	99494	10099	990211	100509	995248	14
47	10077	99491	10128	987338	100512	992389	13
48	10106	99488	10158	984482	100515	989547	12
49	10135	99485	10187	981641	100518	986722	11
50	10164	99482	10216	978817	100521	983912	10
51	10192	99479	10246	976009	100524	981118	9
52	10221	99476	10275	973216	100526	978341	8
53	10250	99473	10305	970441	100530	975579	7
54	10279	99470	10334	967679	100533	972833	6
55	10308	99467	10363	964935	100536	970103	5
56	10337	99464	10393	962204	100539	967387	4
57	10366	99461	10422	959490	100542	964687	3
58	10395	99458	10452	956790	100545	962002	2
59	10424	99455	10481	954106	100548	959332	1
60	10453	99452	10510	951436	100551	956677	0

# TABULÆ

6	Sinuum		Tangētium		Secantium		
0	10453	99452	10510	951436	100551	956677	60
1	10482	99449	10540	948781	100554	954036	59
2	10511	99446	10569	946141	100557	951410	58
3	10540	99443	10599	943514	100560	948799	57
4	10569	99440	10628	940903	100563	946202	56
5	10597	99437	10657	938306	100566	943620	55
6	10626	99434	10687	935722	100569	941051	54
7	10655	99431	10716	933154	100573	938496	53
8	10684	99428	10746	930599	100576	935956	52
9	10713	99424	10775	928058	100579	933430	51
10	10742	99421	10805	925530	100582	930917	50
11	10771	99418	10834	923016	100585	928417	49
12	10800	99415	10863	920515	100588	925931	48
13	10829	99412	10893	918028	100592	923458	47
14	10858	99409	10922	915554	100595	920999	46
15	10887	99406	10952	913093	100598	918553	45
16	10916	99402	10981	910645	100601	916119	44
17	10945	99399	11011	908210	100604	913699	43
18	10973	99396	11040	905788	100608	911292	42
19	11002	99393	11070	903379	100611	908897	41
20	11031	99390	11099	900983	100614	906515	40
21	11060	99386	11128	898599	100617	904146	39
22	11089	99383	11158	896227	100621	901789	38
23	11118	99380	11187	893867	100624	899444	37
24	11147	99377	11217	891520	100627	897111	36
25	11176	99374	11246	889185	100630	894791	35
26	11205	99370	11276	886862	100634	892482	34
27	11234	99367	11305	884551	100637	890185	33
28	11263	99364	11335	882251	100640	887901	32
29	11291	99360	11364	879964	100644	885628	31
30	11320	99357	11394	877688	100647	883367	30

# TABULÆ

6	Sinuum		Tangētium		Secantium		
30	11320	99357	11394	877688	100647	883367	30
31	11349	99354	11423	875424	100650	881117	29
32	11378	99351	11452	873171	100654	878879	28
33	11407	99347	11482	870930	100657	876653	27
34	11436	99344	11511	868701	100660	874437	26
35	11465	99341	11541	866482	100664	872234	25
36	11494	99337	11570	864275	100667	870041	24
37	11523	99334	11600	862079	100671	867859	23
38	11552	99331	11629	859893	100674	865688	22
39	11580	99327	11659	857719	100677	863529	21
40	11609	99324	11688	855555	100681	861380	20
41	11638	99320	11718	853402	100684	859241	19
42	11667	99317	11747	851260	100688	857113	18
43	11696	99314	11777	849128	100691	854996	17
44	11725	99310	11806	847007	100695	852890	16
45	11754	99307	11836	844896	100698	850793	15
46	11783	99303	11865	842796	100702	848708	14
47	11812	99300	11895	840706	100705	846632	13
48	11840	99297	11924	838626	100708	844567	12
49	11869	99293	11954	836556	100712	842512	11
50	11898	99290	11983	834496	100715	840466	10
51	11927	99286	12013	832446	100719	838431	9
52	11956	99283	12042	830406	100722	836406	8
53	11985	99279	12072	828376	100726	834390	7
54	12014	99276	12101	826356	100730	832384	6
55	12043	99272	12131	824345	100733	830388	5
56	12071	99269	12160	822344	100737	828402	4
57	12100	99265	12190	820353	100740	826425	3
58	12129	99262	12219	818371	100744	824458	2
59	12158	99258	12249	816398	100747	822500	1
60	12187	99255	12278	814435	100751	820551	0



# T A B U L Æ

7	Sinuum		Tangētium		Secantium		
0	12187	99255	12278	814435	100751	820551	60
1	12216	99251	12308	812481	100755	818612	59
2	12245	99248	12338	810536	100758	816682	58
3	12274	99244	12367	808601	100762	814761	57
4	12302	99240	12397	806674	100765	812849	56
5	12331	99237	12426	804757	100769	810946	55
6	12360	99233	12456	802848	100773	809052	54
7	12389	99230	12485	800949	100776	807167	53
8	12418	99226	12515	799058	100780	805291	52
9	12447	99222	12544	797176	100784	803423	51
10	12476	99219	12574	795302	100787	801565	50
11	12504	99215	12603	793438	100790	799714	49
12	12533	99211	12633	791581	100795	797874	48
13	12562	99208	12662	789734	100799	796040	47
14	12591	99204	12692	787895	100802	794215	46
15	12620	99200	12722	786064	100806	792399	45
16	12649	99197	12751	784241	100810	790591	44
17	12678	99193	12781	782427	100813	788792	43
18	12706	99189	12810	780622	100817	787001	42
19	12735	99186	12840	778824	100821	785218	41
20	12764	99182	12869	777035	100825	783443	40
21	12793	99178	12899	775253	100828	781676	39
22	12822	99175	12929	773480	100832	779917	38
23	12851	99171	12958	771715	100836	778167	37
24	12880	99167	12988	769957	100840	776424	36
25	12908	99163	13017	768208	100844	774689	35
26	12937	99160	13047	766466	100848	772962	34
27	12966	99156	13076	764732	100851	771242	33
28	12995	99152	13106	763005	100855	769530	32
29	13024	99148	13136	761287	100859	767826	31
30	13053	99144	13165	759576	100863	766130	30

# TABULÆ

7	Sinuum		Tangētium		Secantium		
30	13053	99144	13165	759576	100863	766130	30
31	13081	99141	13195	757872	100867	764441	29
32	13110	99137	13224	756176	100871	762759	28
33	13139	99133	13254	754487	100875	761085	27
34	13168	99129	13284	752806	100878	759419	26
35	13197	99125	13313	751132	100882	757759	25
36	13226	99122	13343	749465	100886	756107	24
37	13254	99118	13372	747806	100890	754462	23
38	13283	99114	13402	746154	100894	752825	22
39	13312	99110	13432	744508	100898	751194	21
40	13341	99106	13461	742871	100902	749571	20
41	13370	99102	13491	741240	100906	747955	19
42	13399	99098	13521	739616	100910	746345	18
43	13427	99094	13550	737999	100914	744743	17
44	13456	99091	13580	736389	100918	743148	16
45	13485	99087	13609	734786	100922	741559	15
46	13514	99083	13639	733190	100926	739978	14
47	13543	99079	13669	731600	100930	738403	13
48	13572	99075	13698	730018	100934	736835	12
49	13600	99071	13728	728442	100938	735274	11
50	13629	99067	13758	726872	100942	733719	10
51	13658	99063	13787	725310	100946	732171	9
52	13687	99059	13817	723754	100950	730630	8
53	13716	99055	13846	722204	100954	729095	7
54	13744	99051	13876	720661	100958	727566	6
55	13773	99047	13906	719125	100962	726044	5
56	13802	99043	13935	717594	100966	724529	4
57	13831	99039	13965	716071	100970	723019	3
58	13860	99035	13995	714553	100975	721517	2
59	13889	99031	14024	713042	100979	720020	1
60	13917	99027	14054	711537	100983	718530	0

# T A B U L Æ

8	Sinuum		Tangētium		Secantium		
0	13917	99027	14054	711537	100983	718530	60
1	13946	99023	14084	710038	100987	717046	59
2	13975	99019	14113	708546	100991	715568	58
3	14004	99015	14143	707059	100995	714096	57
4	14033	99011	14173	705579	100999	712630	56
5	14061	99006	14202	704105	101004	711170	55
6	14090	99002	14232	702636	101008	709717	54
7	14119	98998	14262	701174	101012	708269	53
8	14148	98994	14291	699718	101016	706828	52
9	14177	98990	14321	698268	101020	705392	51
10	14205	98986	14351	696823	101024	703962	50
11	14234	98982	14381	695384	101029	702538	49
12	14263	98978	14410	693952	101033	701120	48
13	14292	98973	14440	692525	101037	699707	47
14	14320	98969	14470	691103	101041	698301	46
15	14349	98965	14499	689688	101046	696900	45
16	14378	98961	14529	688278	101050	695504	44
17	14407	98957	14559	686873	101054	694111	43
18	14436	98953	14588	685474	101059	692730	42
19	14464	98948	14618	684082	101063	691353	41
20	14493	98944	14648	682694	101067	689979	40
21	14522	98940	14678	681312	101071	688612	39
22	14551	98936	14707	679935	101076	687250	38
23	14580	98931	14737	678564	101080	685893	37
24	14608	98927	14767	677199	101084	684542	36
25	14637	98923	14796	675838	101089	683196	35
26	14666	98919	14826	674483	101093	681856	34
27	14695	98914	14856	673133	101098	680521	33
28	14723	98910	14886	671789	101102	679191	32
29	14752	98906	14915	670450	101106	677866	31
30	14781	98902	14945	669116	101111	676547	30

# TABULÆ

8	Sinuum		Tangētium		Secantium		
30	14781	98902	14945	669116	101111	676547	30
31	14810	98897	14975	667787	101115	675233	29
32	14838	98893	15005	666463	101119	673924	28
33	14867	98889	15034	665145	101125	672620	27
34	14896	98884	15064	663831	101128	671321	26
35	14925	98880	15094	662523	101133	670027	25
36	14954	98876	15124	661219	101137	668738	24
37	14982	98871	15153	659921	101142	667455	23
38	15011	98867	15183	658627	101146	666176	22
39	15040	98863	15213	657339	101151	664902	21
40	15069	98858	15243	656055	101155	663633	20
41	15097	98854	15272	654777	101160	662469	19
42	15126	98849	15302	653503	101164	661110	18
43	15155	98845	15332	652234	101169	659855	17
44	15184	98841	15362	650961	101173	658597	16
45	15212	98836	15391	649710	101178	657361	15
46	15241	98832	15421	648456	101182	656121	14
47	15270	98827	15451	647206	101187	654886	13
48	15299	98823	15481	645960	101191	653655	12
49	15327	98818	15511	644720	101196	652429	11
50	15356	98814	15540	643484	101200	651208	10
51	15385	98809	15570	642253	101205	649991	9
52	15414	98805	15600	641026	101209	648779	8
53	15442	98800	15630	639804	101214	647572	7
54	15471	98796	15660	638586	101219	646369	6
55	15500	98791	15689	637373	101223	645170	5
56	15529	98787	15719	636165	101228	643976	4
57	15557	98782	15749	634961	101233	642787	3
58	15586	98778	15779	633761	101237	641602	2
59	15615	98773	15809	632566	101243	640421	1
60	15643	98769	15838	631375	101246	639245	0



# T A B U L Æ

9	Sinuum		Tangētium		Secantium		
0	15643	98709	15838	631375	101247	639245	60
1	15672	98764	15868	630188	101251	638073	59
2	15701	98760	15898	629006	101256	636906	58
3	15730	98755	15928	627828	101261	635742	57
4	15758	98751	15958	626655	101265	634584	56
5	15787	98746	15988	625486	101270	633429	55
6	15816	98741	16017	624321	101275	632279	54
7	15845	98737	16047	623160	101279	631132	53
8	15873	98732	16077	622003	101284	629990	52
9	15902	98728	16107	620851	101287	628853	51
10	15931	98723	16137	619703	101294	627719	50
11	15959	98718	16167	618559	101296	626590	9
12	15988	98714	16196	617419	101303	625464	48
13	16017	98709	16226	616283	101308	624343	47
14	16046	98704	16256	615151	101313	623226	46
15	16074	98700	16286	614023	101317	622113	45
16	16103	98695	16316	612899	101322	621004	44
17	16132	98690	16346	611780	101327	619899	43
18	16160	98686	16376	610664	101332	618797	42
19	16189	98681	16405	609552	101337	617700	41
20	16218	98676	16435	608444	101342	616607	40
21	16246	98671	16465	607340	101346	615517	39
22	16275	98667	16495	606240	101351	614432	38
23	16304	98662	16525	605144	101356	613350	37
24	16333	98657	16555	604051	101361	612273	36
25	16361	98652	16585	602963	101366	611199	35
26	16390	98648	16615	601878	101371	610129	34
27	16419	98643	16645	600797	101376	609062	33
28	16447	98638	16674	599720	101382	608000	32
29	16476	98633	16704	598646	101386	606941	31
30	16505	98629	16734	597577	101390	605886	30



# T A B U L Æ

9	Sinuum		Tangētium		Secantium		
30	16505	98629	16734	597577	101390	605886	30
31	16533	98624	16764	596511	101395	604835	29
32	16562	98619	16794	595449	101400	603787	28
33	16591	98614	16824	594390	101405	602743	27
34	16620	98609	16854	593335	101410	601703	26
35	16648	98604	16884	592284	101415	600666	25
36	16677	98600	16914	591236	101420	599633	24
37	16706	98595	16944	590192	101425	598603	23
38	16734	98590	16974	589151	101430	597577	22
39	16763	98585	17004	588114	101435	596555	21
40	16792	98580	17033	587080	101440	595536	20
41	16820	98575	17063	586050	101445	594521	19
42	16849	98570	17093	585024	101450	593509	18
43	16878	98565	17123	584001	101455	592501	17
44	16906	98561	17153	582981	101460	591496	16
45	16935	98556	17183	581965	101466	590494	15
46	16964	98551	17213	580953	101471	589497	14
47	16992	98546	17243	579944	101476	588502	13
48	17021	98541	17273	578938	101481	587511	12
49	17050	98536	17303	577936	101486	586523	11
50	17078	98531	17333	576937	101491	585539	10
51	17107	98526	17363	575941	101496	584558	9
52	17136	98521	17393	574949	101501	583580	8
53	17164	98516	17423	573960	101506	582606	7
54	17193	98511	17453	572974	101512	581635	6
55	17222	98506	17483	571992	101517	580667	5
56	17250	98501	17513	571013	101522	579703	4
57	17279	98496	17543	570037	101527	578742	3
58	17308	98491	17573	569064	101532	577784	2
59	17336	98486	17603	568095	101537	576829	1
60	17365	98481	17633	567129	101543	575877	0

# T A B U L Æ

Jo	Sinuum		Tangētium		Secantium		
0	17365	98481	17633	567129	101543	575877	60
1	17393	98476	17663	566165	101548	574929	59
2	17422	98471	17693	565205	101553	573984	58
3	17451	98466	17723	564249	101558	573041	57
4	17479	98461	17753	563295	101564	572102	56
5	17508	98455	17783	562344	101569	571167	55
6	17537	98450	17813	561397	101574	570234	54
7	17565	98445	17843	560452	101579	569304	53
8	17594	98440	17873	559511	101585	568377	52
9	17623	98435	17903	558573	101590	567454	51
10	17651	98430	17933	557638	101595	566533	50
11	17680	98425	17963	556705	101601	565615	49
12	17708	98420	17993	555776	101606	564701	48
13	17737	98414	18023	554850	101611	563789	47
14	17760	98409	18053	553927	101616	562881	46
15	17794	98404	18083	553007	101622	561975	45
16	17823	98399	18113	552090	101627	561073	44
17	17852	98394	18143	551175	101633	560173	43
18	17880	98389	18173	550264	101638	559277	42
19	17909	98383	18203	549356	101643	558383	41
20	17937	98378	18233	548450	101649	557492	40
21	17966	98373	18263	547548	101655	556604	39
22	17995	98368	18293	546648	101659	555719	38
23	18023	98362	18323	545751	101665	554837	37
24	18052	98357	18353	544857	101670	553958	36
25	18081	98352	18383	543966	101676	553081	35
26	18109	98347	18414	543077	101681	552208	34
27	18138	98341	18444	542192	101687	551337	33
28	18166	98336	18474	541309	101693	550468	32
2	18195	98331	18504	540429	101698	549603	31
30	18224	98325	18534	539552	101703	548741	30

# T A B U L Æ

Jo	Sinuum		Tangētium		Secantium		
30	18224	98325	18534	539552	101703	548741	30
31	18252	98320	18564	538677	101709	547881	29
32	18281	98315	18594	537806	101714	547024	28
33	18309	98310	18624	536936	101720	546160	27
34	18338	98304	18654	536070	101725	545317	26
35	18367	98299	18684	535206	101731	544468	25
36	18395	98294	18714	534345	101736	543622	24
37	18424	98288	18745	533487	101742	542778	23
38	18452	98283	18775	532631	101747	541937	22
39	18481	98277	18805	531778	101753	541099	21
40	18509	98272	18835	530928	101758	540263	20
41	18538	98267	18865	530080	101764	539430	19
42	18567	98261	18895	529235	101769	538600	18
43	18595	98256	18925	528393	101775	537772	17
44	18624	98250	18955	527553	101781	536947	16
45	18652	98245	18986	526715	101786	536124	15
46	18681	98240	19016	525880	101792	535304	14
47	18710	98234	19046	525048	101798	534486	13
48	18738	98229	19076	524219	101803	533671	12
49	18767	98223	19106	523391	101809	532859	11
50	18795	98218	19136	522567	101815	532049	10
51	18824	98212	19166	521745	101820	531241	9
52	18852	98207	19197	520925	101826	530436	8
53	18881	98201	19227	520108	101832	529634	7
54	18910	98196	19257	519293	101837	528834	6
55	18938	98190	19287	518481	101843	528036	5
56	18967	98185	19317	517671	101849	527241	4
57	18995	98179	19347	516863	101854	526448	3
58	19024	98174	19378	516058	101860	525658	2
59	19052	98168	19408	515256	101866	524870	1
60	19081	98163	19438	514455	101872	524084	0

# TABULÆ

II	Sinuum		Tangētium'		Secantium		
0	19081	98163	19438	514455	101872	524084	60
1	19109	98157	19468	513658	101877	523301	59
2	19138	98152	19498	512852	101883	522521	58
3	19167	98146	19529	512069	101889	521742	57
4	19195	98140	19559	511279	101895	520966	56
5	19224	98135	19589	510490	101901	520193	55
6	19252	98129	19619	509704	101906	519421	54
7	19281	98124	19649	508921	101912	518652	53
8	19309	98118	19680	508139	101918	517886	52
9	19338	98112	19710	507360	101924	517121	51
10	19366	98107	19740	506584	101930	516359	50
11	19395	98101	19770	505809	101936	515599	49
12	19423	98096	19801	505037	101941	514842	48
13	19452	98090	19831	504267	101947	514087	47
14	19481	98084	19861	503499	101953	513334	46
15	19509	98079	19891	502734	101959	512583	45
16	19538	98073	19921	501971	101965	511835	44
17	19566	98067	19952	501210	101971	511088	43
18	19595	98061	19982	500451	101977	510344	42
19	19623	98056	20012	499695	101983	509603	41
20	19652	98050	20042	498940	101989	508863	40
21	19680	98044	20073	498188	101995	508126	39
22	19709	98039	20103	497438	102001	507390	38
23	19737	98033	20133	496690	102007	506657	37
24	19766	98027	20164	495945	102013	505926	36
25	19794	98021	20194	495201	102019	505197	35
26	19823	98016	20224	494460	102025	504471	34
27	19851	98010	20254	493721	102031	503746	33
28	19880	98004	20285	492984	102037	503024	32
29	19908	97998	20315	492249	102043	502303	31
30	19937	97992	20345	491516	102049	501585	30



# TABULÆ

II	Sinuum		Tangētium		Secantium		
30	19937	97992	20345	491516	102049	501585	30
31	19965	97987	20376	490785	102095	500869	29
32	19994	97981	20406	490056	102101	500155	28
33	20022	97975	20436	489329	102107	499443	27
34	20051	97969	20466	488605	102173	498733	26
35	20079	97963	20497	487882	102179	498025	25
36	20108	97958	20527	487162	102185	497320	24
37	20136	97952	20557	486444	102191	496616	23
38	20165	97946	20588	485727	102197	495914	22
39	20193	97940	20618	485013	102103	495214	21
40	20222	97934	20648	484300	102110	494517	20
41	20250	97928	20679	483590	102116	493821	19
42	20279	97922	20709	482882	102122	493128	18
43	20307	97916	20739	482175	102128	492436	17
44	20336	97910	20770	481471	102134	491746	16
45	20364	97905	20800	480768	102140	491058	15
46	20393	97899	20830	480068	102147	490372	14
47	20421	97893	20861	479369	102153	489689	13
48	20450	97887	20891	478673	102159	489007	12
49	20478	97881	20921	477978	102165	488327	11
50	20507	97875	20952	477285	102171	487649	10
51	20535	97869	20982	476595	102178	486973	9
52	20564	97863	21013	475906	102184	486299	8
53	20592	97857	21043	475219	102190	485626	7
54	20620	97851	21073	474534	102196	484956	6
55	20649	97845	21104	473851	102203	484288	5
56	20677	97839	21134	473169	102209	483621	4
57	20706	97833	21164	472490	102216	482956	3
58	20734	97827	21195	471812	102221	482294	2
59	20763	97821	21225	471137	102228	481633	1
60	20791	97815	21256	470463	102234	480973	0



# T A B U L Æ

12	Sinuum		Tangētium		Secantium		
0	20791	97815	21256	470463	102234	480973	60
1	20820	97809	21286	469791	102240	480316	59
2	20848	97803	21316	469121	102247	479661	58
3	20877	97797	21347	468452	102253	479007	57
4	20905	97790	21377	467786	102259	478355	56
5	20933	97784	21408	467121	102266	477705	55
6	20962	97778	21438	466458	102272	477057	54
7	20990	97772	21469	465797	102279	476410	53
8	21019	97766	21499	465138	102285	475766	52
9	21047	97760	21529	464480	102291	475123	51
10	21076	97754	21560	463824	102298	474482	50
11	21104	97748	21590	463170	102304	473843	49
12	21132	97742	21621	462518	102311	473205	48
13	21161	97735	21651	461868	102316	472569	47
14	21189	97729	21682	461219	102323	471935	46
15	21218	97723	21712	460572	102330	471303	45
16	21246	97717	21743	459927	102336	470672	44
17	21275	97711	21773	459283	102343	470044	43
18	21303	97705	21804	458641	102349	469417	42
19	21331	97698	21834	458001	102356	468791	41
20	21360	97692	21864	457363	102362	468168	40
21	21388	97686	21895	456726	102369	467546	39
22	21417	97680	21925	456091	102375	466925	38
23	21445	97673	21956	455458	102382	466307	37
24	21474	97667	21986	454826	102388	465690	36
25	21502	97661	22017	454196	102395	465074	35
26	21530	97655	22047	453568	102402	464461	34
27	21559	97649	22078	452941	102408	463849	33
28	21587	97642	22108	452316	102415	463238	32
29	21616	97636	22139	451693	102421	462630	31
30	21644	97630	22169	451071	102428	462023	30

# T A B U L Æ

12	Sinuum		Tangētium		Secantium		
30	21644	97630	22169	451071	102428	462023	30
31	21672	97623	22200	450451	102435	461417	29
32	21701	97617	22231	449832	102441	460813	28
33	21729	97611	22261	449215	102458	460211	27
34	21758	97604	22292	448600	102454	459611	26
35	21786	97598	22322	447986	102461	459012	25
36	21814	97592	22353	447374	102468	458414	24
37	21843	97585	22383	446764	102474	457819	23
38	21871	97579	22414	446155	102481	457224	22
39	21899	97573	22444	445547	102488	456632	21
40	21928	97566	22475	444942	102494	456041	20
41	21956	97560	22505	444338	102501	455451	19
42	21985	97553	22536	443735	102508	454863	18
43	22013	97547	22567	443134	102515	454277	17
44	22041	97541	22597	442534	102521	453692	16
45	22070	97534	22628	441936	102528	453109	15
46	22098	97528	22658	441340	102535	452527	14
47	22126	97521	22689	440745	102542	451947	13
48	22155	97515	22719	440152	102548	451368	12
49	22183	97508	22750	439560	102555	450791	11
50	22212	97502	22781	438969	102562	450216	10
51	22240	97496	22811	438381	102569	449642	9
52	22268	97489	22842	437793	102576	449069	8
53	22297	97483	22872	437207	102582	448498	7
54	22325	97476	22903	436623	102589	447928	6
55	22353	97470	22934	436040	102596	447360	5
56	22382	97464	22964	435459	102603	446793	4
57	22410	97457	22995	434879	102610	446228	3
58	22438	97450	23026	434300	102617	445664	2
59	22467	97444	23056	433723	102624	445102	1
60	22495	97437	23087	433147	102630	444541	0

# T A B U L Æ

13	Sinuum		Tangētium		Secantium		
0	22495	97437	23087	433147	102630	444541	60
1	22523	97430	23117	432573	102637	443982	59
2	22552	97424	23148	432001	102644	443424	58
3	22580	97417	23179	431429	102651	442867	57
4	22608	97411	23209	430860	102658	442312	56
5	22637	97404	23240	430291	102665	441758	55
6	22665	97398	23271	429724	102672	441206	54
7	22693	97391	23301	429159	102679	440655	53
8	22722	97384	23332	428595	102686	440006	52
9	22750	97378	23363	428032	102693	439558	51
10	22778	97371	23393	427471	102700	439012	50
11	22807	97365	23424	426911	102707	438466	49
12	22835	97358	23455	426352	102714	437923	48
13	22863	97351	23485	425795	102721	437380	47
14	22892	97345	23516	425239	102728	436839	46
15	22920	97338	23547	424685	102735	436300	45
16	22948	97331	23578	424132	102742	435761	44
17	22977	97325	23608	423580	102749	435224	43
18	23005	97318	23639	423030	102756	434689	42
19	23033	97311	23670	422481	102763	434155	41
20	23062	97304	23700	421933	102770	433622	40
21	23090	97298	23731	421387	102777	433090	39
22	23118	97291	23762	420842	102784	432560	38
23	23146	97284	23793	420298	102791	432031	37
24	23175	97278	23823	419756	102799	431503	36
25	23203	97271	23854	419215	102806	430977	35
26	23231	97264	23885	418675	102813	430452	34
27	23260	97257	23916	418137	102820	429929	33
28	23288	97251	23946	417600	102827	429406	32
29	23316	97244	23977	417064	102834	428885	31
30	23345	97237	24008	416530	102842	428366	30

# T A B U L Æ

13	Sinuum		Tangētium		Secantium		
30	233+5	97237	24008	416530	102842	428366	30
31	23373	97230	24039	415997	102849	427847	29
32	23401	97223	24069	415465	102856	427330	28
33	23429	97217	24100	414934	102863	426814	27
34	23458	97210	24131	414405	102870	426300	26
35	23486	97203	24162	413877	102878	425786	25
36	23514	97196	24193	413350	102885	425274	24
37	23542	97189	24223	412825	102892	424764	23
38	23571	97182	24254	412301	102899	424254	22
39	23599	97176	24285	411778	102907	423746	21
40	23627	97169	24316	411256	102914	423239	20
41	23656	97162	24347	410736	102921	422734	19
42	23684	97155	24377	410217	102928	422229	18
43	23712	97148	24408	409699	102936	421726	17
44	23740	97141	24439	409182	102943	421224	16
45	23769	97134	24470	408667	102950	420724	15
46	23797	97127	24501	408152	102958	420224	14
47	23825	97120	24532	407639	102965	419726	13
48	23853	97113	24562	407127	102972	419229	12
49	23882	97106	24593	406617	102980	418733	11
50	23910	97100	24624	406107	102987	418238	10
51	23938	97093	24655	405599	102994	417744	9
52	23966	97086	24686	405092	103002	417252	8
53	23995	97079	24717	404586	103009	416761	7
54	24023	97072	24747	404081	103017	416271	6
55	24051	97065	24778	403578	103024	415782	5
56	24079	97058	24809	403076	103032	415295	4
57	24108	97051	24840	402574	103039	414809	3
58	24136	97044	24871	402074	103046	414323	2
59	24164	97037	24902	401576	103054	413839	1
60	24192	97030	24933	401078	103061	413357	0

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# T A B U L Æ

14	Sinuum		Tangētium		Secantium		
0	24192	97030	24933	401078	103061	413357	60
1	24220	97023	24964	400581	103069	412874	59
2	24249	97015	24995	400086	103076	412394	58
3	24277	97008	25026	399592	103084	411915	57
4	24305	97001	25056	399099	103091	411437	56
5	24333	96994	25087	398607	103099	410960	55
6	24361	96987	25118	398117	103106	410484	54
7	24390	96980	25149	397627	103114	410009	53
8	24418	96973	25180	397139	103121	409535	52
9	24446	96966	25211	396651	103129	409063	51
10	24474	96959	25242	396165	103137	408591	50
11	24503	96952	25273	395680	103144	408121	49
12	24531	96945	25304	395196	103152	407652	48
13	24559	96937	25335	394713	103159	407184	47
14	24587	96930	25366	394232	103167	406717	46
15	24615	96923	25397	393751	103175	406251	45
16	24644	96916	25428	393271	103182	405786	44
17	24672	96909	25459	392793	103190	405322	43
18	24700	96902	25490	392316	103197	404860	42
19	24728	96894	25521	391839	103205	404398	41
20	24756	96887	25552	391364	103213	403938	40
21	24784	96880	25583	390890	103220	403479	39
22	24813	96873	25614	390417	103228	403020	38
23	24841	96866	25645	389945	103236	402563	37
24	24869	96858	25676	389474	103244	402107	36
25	24897	96851	25707	389004	103251	401652	35
26	24925	96844	25738	388536	103259	401198	34
27	24954	96837	25769	388068	103267	400745	33
28	24982	96829	25800	387601	103275	400293	32
29	25010	96822	25831	387136	103281	399843	31
30	25038	96815	25862	386671	103290	399393	30



# TABULÆ

14	Sinuum		Tangētium		Secantium		
30	25038	96815	25862	386671	103290	399393	30
31	25066	96807	25893	386208	103298	398944	29
32	25094	96800	25924	385745	103306	398496	28
33	25122	96793	25955	385284	103313	397050	27
34	25151	96786	25986	384823	103321	397604	26
35	25179	96778	26017	384364	103329	397160	25
36	25207	96771	26048	383906	103337	396716	24
37	25235	96763	26079	383449	103345	396274	23
38	25263	96756	26110	382992	103353	395832	22
39	25291	96749	26141	382537	103360	395392	21
40	25320	96742	26172	382083	103368	394952	20
41	25348	96734	26203	381630	103376	394514	19
42	25376	96727	26235	381177	103384	394076	18
43	25404	96719	26266	380726	103392	393640	17
44	25432	96712	26297	380276	103400	393204	16
45	25460	96704	26328	379827	103408	392770	15
46	25488	96697	26359	379378	103416	392337	14
47	25516	96690	26390	378931	103423	391904	13
48	25545	96682	26421	378485	103432	391473	12
49	25573	96675	26452	378039	103439	391042	11
50	25601	96667	26483	377595	103447	390612	10
51	25629	96660	26515	377152	103455	390184	9
52	25657	96653	26546	376709	103463	389756	8
53	25685	96645	26577	376268	103471	389330	7
54	25713	96638	26608	375828	103479	388904	6
55	25741	96630	26639	375388	103487	388479	5
56	25769	96623	26670	374950	103495	388056	4
57	25798	96615	26701	374512	103503	387633	3
58	25826	96608	26733	374076	103512	387211	2
59	25854	96600	26764	373640	103520	386790	1
60	25882	96593	26795	373205	103528	386370	0

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# TABULÆ

15	Sinuum		Tangētium		Secantium		
0	25882	96593	26795	373205	103528	386370	60
1	25910	96585	26826	371771	103536	385951	59
2	25938	96578	26857	371339	103544	385533	58
3	25966	96570	26888	371907	103552	385116	57
4	25994	96562	26920	371476	103560	384700	56
5	26022	96555	26951	371046	103568	384285	55
6	26050	96547	26982	370617	103576	383871	54
7	26079	96540	27013	370188	103584	383457	53
8	26107	96532	27044	369761	103592	383045	52
9	26135	96524	27076	369335	103601	382633	51
10	26163	96517	27107	368909	103609	382223	50
11	26191	96509	27138	368485	103617	381813	49
12	26219	96502	27169	368061	103625	381404	48
13	26247	96494	27201	367638	103633	380996	47
14	26275	96486	27232	367217	103642	380589	46
15	26303	96479	27263	366796	103650	380183	45
16	26331	96471	27294	366376	103658	379778	44
17	26359	96463	27326	365957	103666	379371	43
18	26387	96456	27357	365538	103674	378970	42
19	26415	96448	27388	365121	103683	378568	41
20	26443	96440	27419	364705	103691	378166	40
21	26471	96433	27451	364289	103699	377765	39
22	26500	96425	27482	363874	103708	377365	38
23	26528	96417	27513	363461	103716	376966	37
24	26556	96410	27545	363048	103724	376568	36
25	26584	96402	27576	362636	103732	376171	35
26	26612	96394	27607	362225	103741	375775	34
27	26640	96386	27639	361814	103749	375379	33
28	26668	96379	27670	361405	103757	374981	32
29	26696	96371	27701	360996	103766	374591	31
30	26724	96363	27732	360588	103774	374198	30

# T A B U L Æ

15	Sinuum	Tangētium	Secantium
30	26724 90363	27732 360588	103774 374198 30
31	26752 90355	27764 360182	103783 373806 29
32	26780 90347	27795 359775	103791 373415 28
33	26808 90340	27826 359370	103799 373024 27
34	26836 90332	27858 358966	103808 372635 26
35	26864 90324	27889 358562	103816 372246 25
36	26892 90316	27920 358160	103825 371858 24
37	26920 90308	27952 357758	103833 371471 23
38	26948 90301	27983 357357	103842 371085 22
39	26976 90293	28015 356957	103850 370699 21
40	27004 90285	28046 356557	103858 370315 20
41	27032 90277	28077 356159	103867 369931 19
42	27060 90269	28109 355761	103875 369548 18
43	27088 90261	28140 355364	103884 369166 17
44	27116 90253	28172 354968	103892 368785 16
45	27144 90246	28203 354573	103901 368405 15
46	27172 90238	28234 354179	103909 368025 14
47	27200 90230	28266 353785	103918 367647 13
48	27228 90222	28297 353393	103927 367269 12
49	27256 90214	28329 353001	103935 366892 11
50	27284 90206	28360 352609	103944 366515 10
51	27312 90198	28391 352219	103952 366140 9
52	27340 90190	28423 351830	103961 365765 8
53	27368 90182	28454 351441	103969 365391 7
54	27396 90174	28486 351053	103978 365018 6
55	27424 90166	28517 350666	103987 364646 5
56	27452 90158	28549 350279	103995 364274 4
57	27480 90150	28580 349894	104004 363903 3
58	27508 90142	28612 349509	104013 363533 2
59	27536 90134	28643 349125	104021 363164 1
60	27564 90126	28675 348741	104030 362796 0

# TABULÆ

16 Sinuum	Tangētium	Secantium	
0	27564 96126	28675 348742	104030 362796 60
1	27592 96118	28706 348359	104039 362428 59
2	27620 96110	28737 347977	104047 362061 58
3	27648 96102	28769 347596	104056 361695 57
4	27676 96094	28800 347216	104065 361330 56
5	27704 96086	28832 346837	104073 360965 55
6	27731 96078	28863 346458	104082 360601 54
7	27759 96070	28895 346080	104091 360238 53
8	27787 96062	28927 345703	104100 359876 52
9	27815 96054	28958 345327	104108 359515 51
10	27843 96046	28990 344951	104117 359154 50
11	27871 96037	29021 344576	104126 358794 49
12	27899 96029	29053 344202	104135 358434 48
13	27927 96021	29084 343829	104144 358076 47
14	27955 96013	29116 343456	104152 357718 46
15	27983 96005	29147 343085	104161 357361 45
16	28011 95997	29179 342713	104170 357005 44
17	28039 95989	29210 342343	104179 356649 43
18	28067 95981	29242 341973	104188 356295 42
19	28095 95972	29274 341605	104197 355941 41
20	28123 95964	29305 341236	104206 355587 40
21	28150 95956	29337 340869	104214 355235 39
22	28178 95948	29368 340502	104223 354883 38
23	28206 95940	29400 340136	104232 354532 37
24	28234 95931	29432 339771	104241 354181 36
25	28262 95923	29463 339406	104250 353831 35
26	28290 95915	29495 339043	104259 353482 34
27	28318 95907	29526 338679	104268 353134 33
28	28346 95898	29558 338317	104277 352787 32
29	28374 95890	29590 337955	104286 352440 31
30	28402 95882	29621 337594	104295 352094 30

# T A B U L Æ

16	Sinuum		Tangētium		Secantium		
30	28402	95582	29621	337594	104295	352094	30
31	28429	95574	29653	337234	104304	351748	29
32	28457	95565	29685	336875	104313	351404	28
33	28485	95557	29716	336516	104322	351060	27
34	28513	95549	29748	336157	104331	350716	26
35	28541	95541	29780	335800	104340	350374	25
36	28569	95532	29811	335443	104349	350032	24
37	28597	95524	29843	335087	104358	349691	23
38	28625	95516	29875	334732	104367	349350	22
39	28652	95507	29906	334377	104376	349010	21
40	28680	95499	29938	334023	104385	348671	20
41	28708	95491	29970	333670	104394	348333	19
42	28736	95482	30001	333317	104403	347995	18
43	28764	95474	30033	332965	104413	347658	17
44	28792	95466	30065	332614	104422	347321	16
45	28820	95457	30097	332264	104431	346986	15
46	28847	95449	30128	331914	104440	346651	14
47	28875	95441	30160	331564	104449	346316	13
48	28903	95432	30192	331216	104458	345983	12
49	28931	95424	30224	330868	104467	345650	11
50	28959	95415	30255	330521	104477	345317	10
51	28987	95407	30287	330174	104486	344986	9
52	29015	95398	30319	329828	104495	344655	8
53	29042	95390	30351	329483	104504	344324	7
54	29070	95381	30382	329139	104514	343995	6
55	29098	95373	30414	328795	104523	343666	5
56	29126	95364	30446	328452	104532	343337	4
57	29154	95356	30478	328109	104541	343009	3
58	29182	95347	30509	327767	104551	342682	2
59	29209	95339	30541	327426	104560	342356	1
60	29237	95330	30573	327085	104569	342030	0



# T A B U L Æ

17	Sinum	Tangētium	Secantium	
0	29237 95630	30573 327085	104569 342030	60
1	29265 95612	30605 326745	104578 341705	59
2	29293 95613	30637 326406	104588 341381	58
3	29321 95605	30669 326067	104597 341057	57
4	29348 95596	30700 325729	104606 340734	56
5	29376 95588	30732 325392	104616 340411	55
6	29404 95579	30764 325055	104625 340089	54
7	29432 95571	30796 324719	104635 339768	53
8	29460 95562	30828 324383	104644 339448	52
9	29487 95554	30860 324049	104653 339128	51
10	29515 95545	30891 323714	104663 338808	50
11	29543 95536	30923 323381	104672 338489	49
12	29571 95528	30955 323048	104682 338171	48
13	29599 95519	30987 322715	104691 337854	47
14	29626 95511	31019 322383	104700 337537	46
15	29654 95502	31051 322052	104710 337221	45
16	29682 95493	31083 321722	104719 336905	44
17	29710 95485	31115 321392	104729 336590	43
18	29737 95476	31147 321063	104738 336276	42
19	29765 95467	31178 320734	104748 335962	41
20	29793 95459	31210 320406	104757 335649	40
21	29821 95450	31242 320079	104767 335336	39
22	29849 95441	31274 319752	104776 335024	38
23	29876 95433	31306 319426	104786 334713	37
24	29904 95424	31338 319100	104795 334402	36
25	29932 95415	31370 318775	104805 334092	35
26	29960 95407	31402 318451	104815 333783	34
27	29987 95398	31434 318127	104824 333474	33
28	30015 95389	31466 317804	104834 333166	32
29	30043 95380	31498 317481	104843 332858	31
30	30071 95372	31530 317159	104853 332551	30

# T A B U L Æ

17	Sinuum		Tangētium		Secantium		
30	30071	95372	31530	317159	104853	332551	10
31	30098	95363	31562	316838	104863	332244	29
32	30126	95354	31594	316517	104872	331939	28
33	30154	95345	31626	316197	104882	331633	27
34	30182	95337	31658	315877	104891	331328	26
35	30209	95328	31690	315558	104901	331024	25
36	30237	95319	31722	315240	104911	330721	24
37	30265	95310	31754	314922	104920	330418	23
38	30292	95301	31786	314605	104930	330115	22
39	30320	95293	31818	314288	104940	329814	21
40	30348	95284	31850	313972	104950	329512	20
41	30376	95275	31882	313656	104959	329212	19
42	30403	95266	31914	313341	104969	328912	18
43	30431	95257	31946	313027	104979	328612	17
44	30459	95248	31978	312713	104989	328313	16
45	30486	95240	32010	312400	104998	328015	15
46	30514	95231	32042	312087	105008	327717	14
47	30542	95222	32074	311775	105018	327420	13
48	30570	95213	32106	311464	105028	327123	12
49	30597	95204	32139	311153	105038	326827	11
50	30625	95195	32171	310842	105047	326531	10
51	30653	95186	32203	310532	105057	326237	9
52	30680	95177	32235	310223	105067	325942	8
53	30708	95168	32267	309914	105077	325648	7
54	30736	95159	32299	309606	105087	325355	6
55	30763	95150	32331	309298	105097	325062	5
56	30791	95142	32363	308991	105107	324770	4
57	30819	95133	32396	308685	105116	324478	3
58	30846	95124	32428	308379	105126	324187	2
59	30874	95115	32460	308073	105136	323897	1
60	30902	95106	32492	307768	105146	323607	0

# T A B U L Æ

18	Sinuum		Tangētium		Secantium		
0	30902	95106	32492	307768	105146	323607	60
1	30929	95097	32524	307464	105156	323317	59
2	30957	95088	32556	307160	105166	323028	58
3	30985	95079	32588	306857	105176	322740	57
4	31012	95070	32621	306554	105186	322452	56
5	31040	95061	32653	306252	105196	322165	55
6	31068	95052	32685	305950	105206	321878	54
7	31095	95043	32717	305649	105216	321592	53
8	31123	95033	32749	305349	105226	321306	52
9	31151	95024	32782	305049	105236	321021	51
10	31178	95015	32814	304749	105246	320737	50
11	31206	95006	32846	304450	105256	320453	49
12	31233	94997	32878	304152	105266	320169	48
13	31261	94988	32911	303854	105276	319886	47
14	31289	94979	32943	303556	105286	319604	46
15	31316	94970	32975	303259	105297	319322	45
16	31344	94961	33007	302963	105307	319040	44
17	31372	94952	33040	302667	105317	318759	43
18	31399	94943	33072	302372	105327	318479	42
19	31427	94933	33104	302077	105337	318199	41
20	31454	94924	33136	301783	105347	317920	40
21	31482	94915	33169	301489	105357	317641	39
22	31510	94906	33201	301196	105367	317363	38
23	31537	94897	33233	300903	105378	317085	37
24	31565	94888	33266	300611	105388	316808	36
25	31593	94878	33298	300319	105398	316531	35
26	31620	94869	33330	300028	105408	316255	34
27	31648	94860	33363	299738	105418	315979	33
28	31675	94851	33395	299447	105429	315703	32
29	31703	94842	33427	299158	105439	315429	31
30	31730	94832	33460	298868	105449	315154	30

# T A B U L Æ

18	Sinum	Tangētium	Secantium	
30	31730	94832	33460 298868	105449 315154 30
31	31758	94823	33492 298580	105459 314881 29
32	31786	94814	33524 298292	105470 314607 28
33	31813	94805	33557 298004	105480 314335 27
34	31841	94795	33589 297717	105490 314062 26
35	31868	94786	33621 297430	105501 313791 25
36	31896	94777	33654 297144	105511 313519 24
37	31924	94768	33686 296858	105521 313249 23
38	31951	94758	33719 296573	105532 312978 22
39	31979	94749	33751 296288	105542 312709 21
40	32006	94740	33783 296004	105552 312439 20
41	32034	94730	33816 295720	105563 312170 19
42	32061	94721	33848 295437	105573 311902 18
43	32089	94712	33881 295154	105584 311635 17
44	32116	94702	33913 294872	105594 311367 16
45	32144	94693	33945 294590	105604 311100 15
46	32171	94684	33978 294309	105615 310834 14
47	32199	94674	34010 294028	105625 310568 13
48	32227	94665	34043 293748	105636 310303 12
49	32254	94656	34075 293468	105646 310038 11
50	32282	94646	34108 293189	105657 309773 10
51	32309	94637	34140 292910	105667 309510 9
52	32337	94627	34173 292631	105678 309246 8
53	32364	94618	34205 292353	105688 308983 7
54	32392	94609	34238 292076	105699 308721 6
55	32419	94599	34270 291799	105709 308458 5
56	32447	94590	34303 291522	105720 308197 4
57	32474	94580	34335 291246	105730 307936 3
58	32502	94571	34368 290971	105741 307675 2
59	32529	94561	34400 290696	105751 307415 1
60	32557	94552	34433 290421	105762 307155 0



# T A B U L Æ

39	Sinum	Tangētium	Secantium
0	32557 94552	34433 290421	105762 307155 60
1	32584 94542	34465 290147	105773 306896 59
2	32612 94533	34498 289873	105783 306637 58
3	32639 94523	34530 289600	105794 306379 57
4	32667 94514	34563 289327	105805 306121 56
5	32694 94504	34596 289055	105815 305864 55
6	32722 94495	34628 288783	105826 305607 54
7	32749 94485	34661 288511	105836 305350 53
8	32777 94476	34693 288240	105847 305094 52
9	32804 94466	34726 287970	105858 304839 51
10	32832 94457	34758 287700	105869 304584 50
11	32859 94447	34791 287430	105879 304329 49
12	32887 94438	34824 287161	105890 304075 48
13	32914 94428	34856 286892	105901 303821 47
14	32942 94418	34889 286624	105911 303568 46
15	32969 94409	34922 286356	105922 303315 45
16	32997 94399	34954 286089	105933 303062 44
17	33024 94390	34987 285822	105944 302810 43
18	33051 94380	35019 285555	105955 302559 42
19	33079 94370	35052 285289	105965 302308 41
20	33106 94361	35085 285023	105976 302057 40
21	33134 94351	35117 284758	105987 301807 39
22	33161 94342	35150 284494	105998 301557 38
23	33189 94332	35183 284229	106009 301308 37
24	33216 94322	35216 283965	106019 301059 36
25	33244 94313	35248 283702	106030 300810 35
26	33271 94303	35281 283439	106041 300562 34
27	33298 94293	35314 283176	106052 300315 33
28	33326 94284	35346 282914	106063 300067 32
29	33353 94274	35379 282653	106074 299821 31
30	33381 94264	35412 282391	106085 299574 30

# TABULÆ

19	Sinum	Tangētium	Secantium
30	33381 94264	35412 282391	106085 299574
31	33408 94254	35445 282130	106096 299328
32	33436 94245	35477 281870	106107 299083
33	33463 94235	35510 281610	106118 298837
34	33490 94225	35543 281350	106129 298593
35	33518 94216	35576 281091	106140 298349
36	33545 94206	35608 280833	106151 298106
37	33573 94196	35641 280574	106162 297862
38	33600 94186	35674 280316	106173 297619
39	33627 94176	35707 280059	106184 297377
40	33655 94167	35740 279802	106195 297135
41	33682 94157	35772 279545	106206 296893
42	33710 94147	35805 279289	106217 296652
43	33737 94137	35838 279033	106228 296411
44	33764 94127	35871 278778	106239 296171
45	33792 94118	35904 278523	106250 295931
46	33819 94108	35937 278269	106261 295691
47	33846 94098	35969 278014	106272 295452
48	33874 94088	36002 277761	106283 295213
49	33901 94078	36035 277507	106295 294975
50	33929 94068	36068 277255	106306 294737
51	33956 94058	36101 277002	106317 294500
52	33983 94049	36134 276750	106328 294263
53	34011 94039	36167 276498	106339 294026
54	34038 94029	36199 276247	106350 293790
55	34065 94019	36232 275996	106362 293554
56	34093 94009	36265 275746	106373 293318
57	34120 93999	36298 275496	106384 293083
58	34147 93989	36331 275246	106395 292849
59	34175 93979	36364 274997	106407 292614
60	34202 93969	36397 274748	106418 292380

# T A B U L Æ

20	Sinum	Tangētium	Secantium				
0	34202	93969	36397	274748	106418	292380	60
1	34229	93959	36430	274499	106429	292147	59
2	34257	93949	36463	274251	106440	291914	58
3	34284	93939	36496	274003	106452	291681	57
4	34311	93929	36529	273756	106463	291449	56
5	34339	93919	36562	273509	106474	291217	55
6	34366	93909	36595	273263	106486	290985	54
7	34393	93899	36628	273017	106497	290754	53
8	34421	93889	36661	272771	106508	290524	52
9	34448	93879	36694	272526	106520	290293	51
10	34475	93869	36727	272281	106531	290063	50
11	34503	93859	36760	272036	106542	289834	49
12	34530	93849	36793	271792	106554	289605	48
13	34557	93839	36826	271548	106565	289376	47
14	34584	93829	36859	271305	106577	289148	46
15	34612	93819	36892	271062	106588	288920	45
16	34639	93809	36925	270819	106600	288692	44
17	34666	93799	36958	270577	106611	288465	43
18	34694	93789	36991	270335	106622	288238	42
19	34721	93779	37024	270094	106634	288011	41
20	34748	93769	37057	269853	106645	287785	40
21	34775	93759	37090	269612	106657	287560	39
22	34803	93748	37123	269371	106668	287334	38
23	34830	93738	37157	269131	106680	287109	37
24	34857	93728	37190	268892	106691	286885	36
25	34885	93718	37223	268653	106703	286660	35
26	34912	93708	37256	268414	106715	286437	34
27	34939	93698	37289	268175	106726	286213	33
28	34966	93688	37322	267937	106738	285990	32
29	34993	93677	37355	267699	106749	285767	31
30	35021	93667	37388	267462	106761	285545	30

# TABULÆ

20	Sinum	Tangētium	Secantium	
30	35021 93667	37388 267462	106761 285545	30
31	35048 93657	37422 267225	106773 285323	29
32	35075 93647	37455 266988	106784 285102	28
33	35102 93637	37488 266752	106796 284880	27
34	35130 93626	37521 266516	106807 284659	26
35	35157 93616	37554 266281	106819 284439	25
36	35184 93606	37588 266046	106831 284219	24
37	35211 93596	37621 265811	106842 283999	23
38	35239 93585	37654 265576	106854 283780	22
39	35266 93575	37687 265342	106866 283560	21
40	35293 93565	37720 265109	106878 283342	20
41	35320 93555	37754 264875	106889 283123	19
42	35347 93544	37787 264642	106901 282906	18
43	35375 93534	37820 264410	106913 282688	17
44	35402 93524	37853 264177	106925 282471	16
45	35429 93514	37887 263945	106936 282254	15
46	35456 93503	37920 263714	106948 282037	14
47	35483 93493	37953 263483	106960 281821	13
48	35511 93483	37988 263252	106972 281605	12
49	35538 93472	38020 263021	106984 281390	11
50	35565 93462	38053 262791	106995 281175	10
51	35592 93452	38086 262561	107007 280960	9
52	35619 93441	38120 262332	107019 280746	8
53	35647 93431	38153 262103	107031 280531	7
54	35674 93420	38186 261874	107043 280318	6
55	35701 93410	38220 261646	107055 280104	5
56	35728 93400	38253 261418	107067 279891	4
57	35755 93389	38286 261190	107079 279679	3
58	35782 93379	38320 260963	107091 279466	2
59	35810 93368	38353 260736	107103 279254	1
60	35837 93358	38386 260509	107114 279043	0



# T A B U L Æ

2)	Sinuum	Tangētium	Secantium				
0	35837	93358	38386	260509	107114	279043	60
1	35864	93348	38420	260283	107126	278832	59
2	35891	93337	38453	260057	107139	278621	58
3	35918	93327	38487	259831	107150	278410	57
4	35945	93316	38520	259606	107162	278200	56
5	35973	93306	38553	259381	107174	277990	55
6	36000	93295	38587	259156	107186	277780	54
7	36027	93285	38620	258932	107198	277571	53
8	36054	93274	38654	258708	107211	277362	52
9	36081	93264	38687	258484	107223	277154	51
10	36108	93253	38721	258261	107235	276945	50
11	36135	93243	38754	258038	107247	276737	49
12	36162	93232	38787	257815	107259	276530	48
13	36190	93222	38821	257593	107271	276323	47
14	36217	93211	38854	257371	107283	276116	46
15	36244	93201	38888	257150	107295	275909	45
16	36271	93190	38921	256928	107307	275703	44
17	36298	93180	38955	256707	107320	275497	43
18	36325	93169	38988	256487	107332	275292	42
19	36352	93159	39022	256266	107344	275086	41
20	36379	93148	39055	256047	107356	274881	40
21	36406	93137	39089	255827	107368	274677	39
22	36434	93127	39122	255608	107380	274473	38
23	36461	93116	39156	255389	107393	274269	37
24	36488	93106	39190	255170	107405	274065	36
25	36515	93095	39223	254952	107417	273863	35
26	36542	93084	39257	254734	107429	273659	34
27	36569	93074	39290	254515	107442	273456	33
28	36596	93063	39324	254299	107454	273254	32
29	36623	93052	39357	254081	107466	273052	31
30	36650	93042	39391	253865	107479	272850	30

# T A B U L Æ

2) Sinuum			Tangētium		Secantium		
30	36650	93042	39391	253865	107479	272850	30
31	36677	93031	39425	253648	107491	272649	29
32	36704	93020	39458	253432	107503	272448	28
33	36731	93010	39492	253217	107516	272247	27
34	36758	92999	39526	253001	107528	272047	26
35	36785	92988	39559	252786	107540	271847	25
36	36812	92978	39593	252571	107553	271647	24
37	36840	92967	39626	252357	107565	271448	23
38	36867	92956	39660	252142	107578	271249	22
39	36894	92946	39694	251929	107590	271050	21
40	36921	92935	39727	251715	107602	270851	20
41	36948	92924	39761	251502	107615	270653	19
42	36975	92913	39795	251282	107627	270455	18
43	37002	92903	39829	251076	107640	270258	17
44	37029	92892	39862	250864	107652	270061	16
45	37056	92881	39896	250652	107665	269864	15
46	37083	92870	39930	250440	107677	269667	14
47	37110	92859	39963	250229	107690	269471	13
48	37137	92849	39997	250018	107702	269275	12
49	37164	92838	40031	249807	107715	269079	11
50	37191	92827	40065	249597	107727	268884	10
51	37218	92816	40098	249386	107740	268689	9
52	37245	92805	40132	249177	107752	268494	8
53	37272	92794	40166	248967	107765	268299	7
54	37299	92784	40200	248758	107778	268105	6
55	37326	92773	40234	248549	107790	267911	5
56	37353	92762	40267	248340	107803	267718	4
57	37380	92751	40301	248132	107815	267524	3
58	37407	92740	40335	247924	107828	267332	2
59	37434	92729	40369	247716	107841	267139	1
60	37461	92718	40403	247509	107853	266947	0

# TABULÆ

22	Sinuum		Tangētium		Secantium		
0	37461	92718	40403	247509	107853	266947	60
1	37488	92707	40436	247302	107860	266755	59
2	37515	92697	40470	247095	107879	266563	58
3	37542	92686	40504	246888	107892	266371	57
4	37569	92675	40538	246682	107904	266180	56
5	37595	92664	40572	246476	107917	265989	55
6	37622	92653	40606	246270	107930	265799	54
7	37649	92642	40640	246065	107942	265609	53
8	37676	92631	40674	245860	107955	265419	52
9	37703	92620	40707	245655	107968	265229	51
10	37730	92609	40741	245451	107981	265040	50
11	37757	92598	40775	245246	107994	264851	49
12	37784	92587	40809	245043	108006	264662	48
13	37811	92576	40843	244839	108019	264473	47
14	37838	92565	40877	244636	108032	264285	46
15	37865	92554	40911	244433	108045	264097	45
16	37892	92543	40945	244230	108058	263909	44
17	37919	92532	40979	244027	108071	263722	43
18	37946	92521	41013	243825	108084	263535	42
19	37973	92510	41047	243623	108097	263348	41
20	37999	92499	41081	243422	108109	263162	40
21	38026	92488	41115	243220	108122	262976	39
22	38053	92477	41149	243019	108135	262790	38
23	38080	92466	41183	242819	108148	262604	37
24	38107	92455	41217	242618	108161	262419	36
25	38134	92444	41251	242418	108174	262234	35
26	38161	92432	41285	242218	108187	262049	34
27	38188	92421	41319	242018	108200	261864	33
28	38215	92410	41353	241819	108213	261680	32
29	38241	92399	41387	241620	108226	261496	31
30	38268	92388	41421	241421	108239	261313	30

# T A B U L Æ

22	Sinuum		Tangētium		Secantium		
30	38268	92388	41421	241421	108239	261313	30
31	38295	92377	41455	241223	108252	261129	29
32	38322	92366	41490	241025	108265	260946	28
33	38349	92355	41524	240827	108278	260763	27
34	38376	92343	41558	240629	108291	260581	26
35	38403	92332	41592	240432	108305	260399	25
36	38430	92321	41626	240235	108318	260217	24
37	38456	92310	41660	240038	108331	260035	23
38	38483	92299	41694	239841	108344	259853	22
39	38510	92287	41728	239645	108357	259672	21
40	38537	92276	41763	239449	108370	259491	20
41	38564	92265	41797	239253	108383	259311	19
42	38591	92254	41831	239058	108397	259130	18
43	38617	92243	41865	238863	108410	258950	17
44	38644	92231	41899	238668	108423	258771	16
45	38671	92220	41933	238473	108436	258591	15
46	38698	92209	41968	238279	108449	258412	14
47	38725	92198	42002	238084	108463	258233	13
48	38752	92186	42036	237891	108476	258054	12
49	38778	92175	42070	237697	108489	257876	11
50	38805	92164	42105	237504	108503	257698	10
51	38832	92152	42139	237311	108516	257520	9
52	38859	92141	42173	237118	108529	257342	8
53	38886	92130	42207	236925	108542	257165	7
54	38912	92119	42242	236733	108556	256988	6
55	38939	92107	42276	236541	108569	256811	5
56	38966	92096	42310	236349	108582	256634	4
57	38993	92085	42345	236158	108596	256458	3
58	39020	92073	42379	235967	108609	256282	2
59	39046	92062	42413	235776	108623	256106	1
60	39073	92050	42447	235585	108636	255931	0



# T A B U L Æ

23	Sinuum		Tangētium		Secantium		
0	39073	92050	42447	235585	108636	255931	60
1	39100	92039	42482	235395	108649	255755	59
2	39127	92028	42516	235205	108663	255580	58
3	39153	92016	42551	235015	108676	255406	57
4	39180	92005	42585	234825	108690	255230	56
5	39207	91994	42619	234636	108703	255057	55
6	39234	91982	42654	234447	108717	254883	54
7	39260	91971	42688	234258	108730	254709	53
8	39287	91959	42722	234069	108744	254536	52
9	39314	91948	42757	233881	108757	254362	51
10	39341	91936	42791	233693	108771	254190	50
11	39367	91925	42826	233505	108784	254017	49
12	39394	91914	42860	233317	108798	253844	48
13	39421	91902	42894	233130	108811	253672	47
14	39448	91891	42929	232943	108825	253500	46
15	39474	91879	42963	232756	108839	253329	45
16	39501	91868	42998	232570	108852	253157	44
17	39528	91856	43032	232383	108866	252986	43
18	39555	91845	43067	232197	108880	252815	42
19	39581	91833	43101	232012	108893	252645	41
20	39608	91822	43136	231826	108907	252474	40
21	39635	91810	43170	231641	108921	252304	39
22	39661	91799	43205	231456	108934	252134	38
23	39688	91787	43239	231271	108948	251965	37
24	39715	91775	43274	231086	108962	251795	36
25	39741	91764	43308	230902	108975	251626	35
26	39768	91752	43343	230718	108989	251457	34
27	39795	91741	43378	230534	109003	251289	33
28	39822	91729	43412	230351	109017	251120	32
29	39848	91718	43447	230167	109030	250952	31
30	39875	91706	43481	229984	109044	250784	30

# TABULÆ

23	Sinuum		Tangētium		Secantium		
30	39875	91706	43481	229984	109044	250784	30
31	39902	91694	43516	229801	109058	250617	29
32	39928	91683	43550	229619	109072	250449	28
33	39955	91671	43585	229437	109086	250282	27
34	39982	91660	43620	229254	109099	250115	26
35	40008	91648	43654	229073	109113	249948	25
36	40035	91636	43689	228891	109127	249782	24
37	40062	91625	43724	228710	109141	249616	23
38	40088	91613	437 8	228528	109155	249450	22
39	40115	91601	437 3	228348	109169	249284	21
40	40141	91590	438 8	228167	109183	249119	20
41	40168	91578	438 2	227987	109197	248954	19
42	40195	91566	43897	227806	109211	248789	18
43	40221	91555	43932	227626	109224	248624	17
44	40248	91543	43966	227447	109238	248459	16
45	40275	91531	44001	227267	109252	248295	15
46	40301	91519	44036	227088	109266	248131	14
47	40328	91508	44071	226909	109280	247967	13
48	40355	91496	44105	226730	109294	247804	12
49	40381	91484	44140	226552	109308	247640	11
50	40408	91472	44175	226374	109322	247477	10
51	40434	91461	44210	226196	109337	247314	9
52	40461	91449	44244	226018	109351	247152	8
53	40488	91437	44279	225840	109365	246989	7
54	40514	91425	44313	225663	109379	246827	6
55	40541	91414	44349	225486	109393	246665	5
56	40567	91402	44384	225309	109407	246504	4
57	40594	91390	44418	225132	109421	246342	3
58	40620	91378	44453	224956	109435	246181	2
59	40647	91366	44488	224780	109449	246020	1
60	40674	91355	44523	224604	109464	245859	0

# T A B U L Æ

24	Sinuum		Tangētium		Secantium		
0	40674	91355	44523	224604	109464	245859	60
1	40700	91343	44558	224428	109478	245699	59
2	40727	91331	44593	224253	109492	245539	58
3	40753	91319	44627	224077	109507	245379	57
4	40780	91307	44662	223902	109520	245219	56
5	40806	91295	44697	223727	109535	245059	55
6	40833	91283	44732	223553	109549	244900	54
7	40860	91272	44767	223378	109563	244741	53
8	40886	91260	44802	223204	109577	244582	52
9	40913	91248	44837	223030	109592	244423	51
10	40939	91236	44872	222857	109606	244264	50
11	40966	91224	44907	222683	109620	244106	49
12	40992	91212	44942	222510	109635	243948	48
13	41019	91200	44977	222337	109649	243790	47
14	41045	91188	45012	222164	109663	243633	46
15	41072	91176	45047	221992	109678	243476	45
16	41098	91164	45082	221819	109692	243318	44
17	41125	91152	45117	221647	109707	243162	43
18	41151	91140	45152	221475	109721	243005	42
19	41178	91128	45187	221304	109735	242848	41
20	41204	91116	45222	221132	109750	242692	40
21	41231	91104	45257	220961	109764	242536	39
22	41257	91092	45292	220790	109779	242380	38
23	41284	91080	45327	220619	109793	242225	37
24	41310	91068	45362	220449	109808	242070	36
25	41337	91056	45397	220278	109822	241914	35
26	41363	91044	45432	220108	109837	241760	34
27	41390	91032	45467	219938	109851	241605	33
28	41416	91020	45502	219769	109866	241450	32
29	41443	91008	45538	219599	109880	241296	31
30	41469	90996	45573	219430	109895	241142	30

# T A B U L Æ

24	Sinum	Tangentium	Secantium				
30	41469	90996	45573	219430	109895	241142	30
31	41496	90984	45608	219261	109909	240988	29
32	41522	90972	45643	219092	109924	240835	28
33	41549	90960	45678	218923	109939	240681	27
34	41575	90948	45713	218755	109953	240528	26
35	41602	90936	45748	218587	109968	240375	25
36	41628	90924	45784	218419	109982	240222	24
37	41655	90911	45819	218251	109997	240070	23
38	41681	90899	45854	218084	110012	239918	22
39	41707	90887	45889	217916	110026	239766	21
40	41734	90875	45924	217749	110041	239614	20
41	41760	90863	45960	217582	110056	239462	19
42	41787	90851	45995	217416	110071	239311	18
43	41813	90839	46030	217249	110085	239159	17
44	41840	90826	46065	217083	110100	239008	16
45	41866	90814	46101	216918	110115	238858	15
46	41892	90802	46136	216751	110130	238707	14
47	41919	90790	46171	216585	110144	238556	13
48	41945	90778	46207	216420	110159	238406	12
49	41972	90766	46242	216255	110174	238256	11
50	41998	90753	46277	216090	110189	238106	10
51	42024	90741	46312	215925	110204	237957	9
52	42051	90729	46348	215760	110218	237808	8
53	42077	90717	46383	215596	110233	237658	7
54	42104	90704	46418	215432	110248	237509	6
55	42130	90692	46454	215268	110263	237361	5
56	42156	90680	46489	215104	110278	237212	4
57	42183	90668	46525	214940	110293	237064	3
58	42209	90655	46560	214777	110308	236916	2
59	42235	90643	46595	214614	110323	236768	1
60	42262	90631	46631	214451	110338	236620	0



# TABULÆ

25	Sinum	Tangētium	Secantium	
0	42262 90631	46631 214451	110338 236620	60
1	42288 90618	46666 214288	110353 236473	59
2	42315 90606	46702 214125	110368 236325	58
3	42341 90594	46737 213963	110383 236178	57
4	42367 90582	46772 213801	110398 236031	56
5	42394 90569	46808 213639	110413 235885	55
6	42420 90557	46843 213477	110428 235738	54
7	42446 90545	46879 213316	110443 235592	53
8	42473 90532	46914 213154	110458 235446	52
9	42499 90520	46950 212993	110473 235300	51
10	42525 90507	46985 212832	110488 235154	50
11	42552 90495	47021 212671	110503 235009	49
12	42578 90483	47056 212511	110518 234863	48
13	42604 90470	47092 212350	110533 234718	47
14	42631 90458	47128 212190	110549 234573	46
15	42657 90446	47163 212030	110564 234429	45
16	42683 90433	47199 211871	110579 234284	44
17	42709 90421	47234 211711	110594 234140	43
18	42736 90408	47270 211552	110609 233996	42
19	42762 90396	47305 211392	110625 233852	41
20	42788 90383	47341 211233	110640 233708	40
21	42815 90371	47377 211075	110655 233565	39
22	42841 90358	47412 210916	110670 233421	38
23	42867 90346	47448 210758	110686 233278	37
24	42894 90334	47484 210599	110701 233135	36
25	42920 90321	47519 210441	110716 232993	35
26	42946 90309	47555 210284	110731 232850	34
27	42972 90296	47590 210126	110747 232708	33
28	42999 90284	47626 209969	110762 232566	32
29	43025 90271	47662 209811	110777 232424	31
30	43051 90259	47698 209654	110793 232282	30

# T A B U L Æ

25	Sinuum		Tangētium		Secantium		
30	43051	90259	47698	209654	110793	232282	30
31	43077	90246	47733	209498	110808	232140	29
32	43104	90233	47769	209341	110824	231999	28
33	43130	90221	47805	209184	110839	231858	27
34	43156	90208	47840	209028	110854	231717	26
35	43182	90196	47876	208872	110870	231576	25
36	43209	90183	47912	208716	110885	231436	24
37	43235	90171	47948	208560	110901	231295	23
38	43261	90158	47984	208405	110916	231155	22
39	43287	90146	48019	208250	110932	231015	21
40	43313	90133	48055	208094	110947	230875	20
41	43340	90120	48091	207939	110963	230735	19
42	43366	90108	48127	207785	110978	230596	18
43	43392	90095	48163	207630	110994	230457	17
44	43418	90082	48198	207476	111009	230317	16
45	43445	90070	48234	207321	111025	230179	15
46	43471	90057	48270	207167	111041	230040	14
47	43497	90045	48306	207014	111056	229901	13
48	43523	90032	48342	206860	111072	229763	12
49	43549	90019	48378	206706	111087	229625	11
50	43575	90007	48414	206553	111103	229487	10
51	43602	89994	48450	206400	111119	229349	9
52	43628	89981	48486	206247	111134	229211	8
53	43654	89968	48521	206094	111150	229074	7
54	43680	89956	48557	205942	111166	228937	6
55	43706	89943	48593	205789	111181	228800	5
56	43733	89930	48629	205637	111197	228663	4
57	43759	89918	48665	205485	111213	228526	3
58	43785	89905	48701	205333	111229	228390	2
59	43811	89892	48737	205182	111244	228253	1
60	43837	89879	48773	205030	111260	228117	0

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26	Sinum	Tangētium	Secantium
0	43837 89879	48773 205030	111260 228117 60
1	43863 89867	48809 204879	111276 227981 59
2	43889 89854	48845 204728	111292 227845 58
3	43916 89841	48881 204577	111308 227710 57
4	43942 89828	48917 204426	111323 227574 56
5	43968 89816	48953 204276	111339 227439 55
6	43994 89803	48989 204125	111355 227304 54
7	44020 89790	49026 203975	111371 227169 53
8	44046 89777	49062 203825	111387 227035 52
9	44072 89764	49098 203675	111403 226900 51
10	44098 89752	49134 203526	111419 226766 50
11	44124 89739	49170 203376	111435 226632 49
12	44151 89726	49206 203227	111451 226498 48
13	44177 89713	49242 203078	111467 226364 47
14	44203 89700	49278 202929	111483 226230 46
15	44229 89687	49315 202780	111499 226097 45
16	44255 89674	49351 202631	111515 225963 44
17	44281 89662	49387 202483	111531 225830 43
18	44307 89649	49423 202335	111547 225697 42
19	44333 89636	49459 202187	111563 225565 41
20	44359 89623	49495 202039	111579 225432 40
21	44385 89610	49532 201891	111595 225300 39
22	44411 89597	49568 201743	111611 225167 38
23	44437 89584	49604 201596	111627 225035 37
24	44464 89571	49640 201449	111643 224903 36
25	44490 89558	49677 201302	111659 224772 35
26	44516 89545	49713 201155	111675 224640 34
27	44542 89532	49749 201008	111691 224509 33
28	44568 89519	49786 200862	111708 224378 32
29	44594 89506	49822 200715	111724 224247 31
30	44620 89493	49858 200569	111740 224116 30

# T A B U L Æ

26	Sinuum		Tangētium		Secantium		
30	44620	89493	49858	200569	111740	224116	30
31	44646	89480	49894	200423	111756	223985	29
32	44672	89467	49931	200277	111772	223855	28
33	44698	89454	49967	200131	111789	223724	27
34	44724	89441	50004	199986	111805	223594	26
35	44750	89428	50040	199841	111821	223464	25
36	44776	89415	50076	199695	111838	223334	24
37	44802	89402	50113	199550	111854	223205	23
38	44828	89389	50149	199406	111870	223075	22
39	44854	89396	50185	199261	111886	222946	21
40	44880	89363	50222	199116	111903	222817	20
41	44906	89350	50258	198972	111919	222688	19
42	44932	89337	50295	198828	111936	222559	18
43	44958	89324	50331	198684	111952	222430	17
44	44984	89311	50368	198540	111968	222302	16
45	45010	89298	50404	198396	111985	222174	15
46	45036	89285	50441	198253	112001	222045	14
47	45062	89272	50477	198110	112018	221918	13
48	45088	89259	50514	197966	112034	221790	12
49	45114	89245	50550	197823	112051	221662	11
50	45140	89232	50587	197680	112067	221535	10
51	45166	89219	50623	197538	112083	221407	9
52	45192	89206	50660	197395	112100	221280	8
53	45218	89193	50696	197253	112117	221153	7
54	45243	89180	50733	197111	112133	221026	6
55	45269	89167	50769	196969	112150	220900	5
56	45295	89153	50806	196827	112166	220773	4
57	45321	89140	50843	196685	112183	220647	3
58	45347	89127	50879	196544	112199	220521	2
59	45373	89114	50916	196402	112216	220395	1
60	45399	89101	50953	196261	112233	220269	0



# T A B U L Æ

27	Sinuum	Tangētium	Secantium
0	45399 89101	50953 196261	112233 220269 60
1	45425 89087	50989 196120	112249 220143 59
2	45451 89074	51026 195979	112266 220018 58
3	45477 89061	51063 195838	112283 219892 57
4	45503 89048	51099 195698	112299 219767 56
5	45529 89035	51136 195557	112316 219642 55
6	45554 89021	51173 195417	112333 219517 54
7	45580 89008	51209 195277	112349 219393 53
8	45606 88995	51246 195137	112366 219268 52
9	45632 88981	51283 194997	112383 219144 51
10	45658 88968	51319 194858	112400 219019 50
11	45684 88955	51356 194718	112416 218895 49
12	45710 88942	51393 194579	112433 218771 48
13	45736 88928	51430 194440	112450 218648 47
14	45762 88915	51467 194301	112467 218524 46
15	45787 88902	51503 194162	112484 218401 45
16	45813 88888	51540 194023	112501 218277 44
17	45839 88875	51577 193885	112518 218154 43
18	45865 88862	51614 193746	112534 218031 42
19	45891 88848	51651 193608	112551 217909 41
20	45917 88835	51688 193470	112568 217786 40
21	45943 88822	51724 193332	112585 217663 39
22	45968 88808	51761 193195	112602 217541 38
23	45994 88795	51798 193057	112619 217419 37
24	46020 88782	51835 192920	112636 217297 36
25	46046 88768	51872 192782	112653 217175 35
26	46072 88755	51909 192645	112670 217053 34
27	46097 88741	51946 192508	112687 216932 33
28	46123 88728	51983 192371	112704 216810 32
29	46149 88715	52020 192235	112721 216689 31
30	46175 88701	52057 192098	112738 216568 30

# TABULÆ

27	Sinuum		Tangētium		Secantium		
30	46175	88701	52057	192098	112738	216568	30
31	46201	88688	52094	191962	112755	216447	29
32	46226	88674	52131	191826	112772	216326	28
33	46252	88661	52168	191690	112789	216206	27
34	46278	88647	52209	191554	112807	216085	26
35	46304	88634	52242	191418	112824	215965	25
36	46330	88620	52279	191282	112841	215845	24
37	46355	88607	52316	191147	112858	215725	23
38	46381	88593	52353	191012	112875	215605	22
39	46407	88580	52390	190876	112892	215485	21
40	46433	88566	52427	190741	112910	215366	20
41	46458	88553	52464	190607	112927	215246	19
42	46484	88539	52501	190472	112944	215127	18
43	46510	88526	52538	190337	112961	215008	17
44	46536	88512	52575	190203	112979	214889	16
45	46561	88499	52613	190069	112996	214770	15
46	46587	88485	52650	189935	113013	214651	14
47	46613	88472	52687	189801	113031	214533	13
48	46639	88458	52724	189667	113048	214414	12
49	46664	88445	52761	189533	113065	214296	11
50	46690	88431	52798	189400	113083	214178	10
51	46716	88417	52836	189266	113100	214060	9
52	46742	88404	52873	189133	113117	213942	8
53	46767	88390	52910	189000	113135	213825	7
54	46793	88377	52947	188867	113152	213707	6
55	46819	88363	52985	188734	113170	213590	5
56	46844	88349	53022	188602	113187	213473	4
57	46870	88336	53059	188469	113205	213356	3
58	46896	88322	53096	188337	113222	213239	2
59	46921	88308	53134	188205	113239	213122	1
60	6947	88295	53171	188072	113257	213005	0

# T A B U L Æ

28	Sinum	Tangētium	Secantium				
0	46947	86295	53171	188073	113257	213005	60
1	46973	86281	53208	187941	113275	212889	59
2	46999	86267	53246	187809	113292	212773	58
3	47024	86254	53283	187677	113310	212657	57
4	47050	86240	53320	187546	113327	212540	56
5	47076	86226	53358	187415	113345	212425	55
6	47101	86213	53395	187283	113362	212309	54
7	47127	86199	53432	187152	113380	212193	53
8	47152	86185	53470	187021	113398	212078	52
9	47178	86172	53507	186891	113415	211963	51
10	47204	86158	53545	186760	113433	211847	50
11	47229	86144	53582	186630	113451	211732	49
12	47255	86130	53620	186499	113468	211617	48
13	47281	86117	53657	186369	113486	211503	47
14	47306	86103	53694	186239	113504	211388	46
15	47332	86089	53732	186109	113521	211274	45
16	47358	86075	53769	185979	113539	211159	44
17	47383	86062	53807	185850	113557	211045	43
18	47409	86048	53844	185720	113575	210931	42
19	47434	86034	53882	185591	113593	210817	41
20	47460	86020	53920	185462	113610	210704	40
21	47486	86006	53957	185332	113628	210590	39
22	47511	87993	53995	185204	113646	210477	38
23	47537	87979	54032	185075	113664	210363	37
24	47562	87965	54070	184946	113682	210250	36
25	47588	87951	54107	184818	113700	210137	35
26	47614	87937	54145	184689	113718	210024	34
27	47639	87923	54183	184561	113735	209911	33
28	47665	87909	54220	184433	113753	209799	32
29	47690	87896	54258	184305	113771	209686	31
30	47716	87882	54296	184177	113789	209574	30

# T A B U L Æ

28	Sinuum		Tangētium		Secantium		
30	47716	87882	54296	184177	113789	209574	30
31	47741	87868	54333	184049	113807	209462	29
32	47767	87854	54371	183922	113825	209350	28
33	47793	87840	54409	183794	113843	209238	27
34	47818	87826	54446	183667	113861	209126	26
35	47844	87812	54484	183540	113879	209015	25
36	47869	87798	54522	183413	113897	208903	24
37	47895	87784	54560	183286	113916	208791	23
38	47920	87770	54597	183159	113934	208680	22
39	47946	87756	54635	183033	113952	208569	21
40	47971	87743	54673	182906	113970	208458	20
41	47997	87729	54711	182780	113988	208347	19
42	48022	87715	54748	182654	114006	208236	18
43	48048	87701	54786	182528	114024	208126	17
44	48073	87687	54824	182402	114042	208015	16
45	48099	87673	54862	182276	114061	207905	15
46	48124	87659	54900	182150	114079	207795	14
47	48150	87645	54938	182025	114097	207685	13
48	48175	87631	54975	181899	114115	207575	12
49	48201	87617	55013	181774	114134	207465	11
50	48226	87603	55051	181649	114152	207356	10
51	48252	87589	55089	181524	114170	207246	9
52	48277	87575	55127	181399	114188	207137	8
53	48303	87561	55165	181274	114207	207027	7
54	48328	87546	55203	181150	114225	206918	6
55	48354	87532	55241	181025	114243	206809	5
56	48379	87518	55279	180901	114262	206701	4
57	48405	87504	55317	180777	114280	206592	3
58	48430	87490	55355	180653	114299	206483	2
59	48456	87476	55393	180529	114317	206375	1
60	48481	87462	55431	180405	114335	206267	0



# T A B U L Æ

29	Sinum	Tangētium	Secantium
0	48481	87462	55431 180405 114335 206267 60
1	48506	87448	55469 180281 114354 206158 59
2	48532	87434	55507 180158 114372 206050 58
3	48557	87420	55545 180034 114391 205942 57
4	48583	87406	55583 179911 114409 205835 56
5	48608	87391	55621 179788 114428 205727 55
6	48634	87377	55659 179665 114446 205619 54
7	48659	87363	55697 179542 114465 205512 53
8	48684	87349	55735 179419 114483 205405 52
9	48710	87335	55774 179296 114502 205298 51
10	48735	87321	55812 179174 114521 205191 50
11	48761	87306	55850 179051 114539 205084 49
12	48786	87292	55888 178929 114558 204977 48
13	48811	87278	55926 178807 114576 204870 47
14	48837	87264	55964 178685 114595 204764 46
15	48862	87250	56003 178563 114614 204658 45
16	48887	87235	56041 178441 114632 204551 44
17	48913	87221	56079 178319 114651 204445 43
18	48938	87207	56117 178198 114670 204339 42
19	48964	87193	56156 178076 114688 204233 41
20	48989	87178	56194 177955 114707 204128 40
21	49014	87164	56232 177834 114726 204022 39
22	49040	87150	56270 177713 114745 203916 38
23	49065	87136	56309 177592 114764 203811 37
24	49090	87121	56347 177471 114782 203706 36
25	49116	87107	56385 177351 114801 203601 35
26	49141	87093	56424 177230 114820 203496 34
27	49166	87079	56462 177110 114839 203391 33
28	49192	87064	56500 176990 114858 203286 32
29	49217	87050	56539 176869 114877 203182 31
30	49242	87036	56577 176749 114896 203077 30

# T A B U L Æ

29	Sinum	Tangētium	Secantium	
30	49242	87036	56577	176749
31	49268	87021	56616	176629
32	49293	87007	56654	176510
33	49318	86993	56693	176390
34	49344	86978	56731	176271
35	49369	86964	56769	176151
36	49394	86949	56808	176032
37	49419	86935	56846	175913
38	49445	86921	56885	175794
39	49470	86906	56923	175675
40	49495	86892	56962	175556
41	49521	86878	57000	175437
42	49546	86863	57039	175319
43	49571	86849	57078	175200
44	49596	86834	57116	175082
45	49622	86820	57155	174964
46	49647	86805	57193	174846
47	49672	86791	57232	174728
48	49697	86777	57271	174610
49	49723	86762	57309	174492
50	49748	86748	57348	174375
51	49773	86733	57386	174257
52	49798	86719	57425	174140
53	49824	86704	57464	174022
54	49849	86690	57503	173905
55	49874	86675	57541	173788
56	49899	86661	57580	173671
57	49924	86646	57619	173555
58	49950	86632	57657	173438
59	49975	86617	57696	173321
60	50000	86603	57735	173205

# T A B U L Æ

30	Sinuum		Tangētium		Secantium		
0	50000	86603	57735	173205	115470	200000	60
1	50025	86588	57774	173089	115489	199899	59
2	50050	86573	57813	172973	115509	199799	58
3	50076	86559	57851	172857	115528	199698	57
4	50101	86544	57890	172741	115548	199598	56
5	50126	86530	57929	172625	115567	199498	55
6	50151	86515	57968	172509	115587	199397	54
7	50176	86501	58007	172393	115606	199297	53
8	50201	86486	58046	172278	115626	199198	52
9	50227	86471	58085	172163	115645	199098	51
10	50252	86457	58124	172047	115665	198998	50
11	50277	86442	58162	171932	115684	198899	49
12	50302	86427	58201	171817	115704	198799	48
13	50327	86413	58240	171702	115724	198700	47
14	50352	86398	58279	171588	115743	198601	46
15	50377	86384	58318	171473	115763	198502	45
16	50403	86369	58357	171358	115782	198403	44
17	50428	86354	58397	171244	115802	198304	43
18	50453	86340	58435	171129	115822	198205	42
19	50478	86325	58474	171015	115841	198107	41
20	50503	86316	58513	170901	115861	198008	40
21	50528	86295	58552	170787	115881	197910	39
22	50553	86281	58591	170673	115901	197811	38
23	50578	86266	58631	170560	115920	197713	37
24	50603	86251	58670	170446	115940	197615	36
25	50628	86237	58709	170332	115960	197517	35
26	50654	86222	58748	170219	115980	197420	34
27	50679	86207	58787	170106	116000	197322	33
28	50704	86192	58826	169992	116019	197224	32
29	50729	86178	58865	169879	116039	197127	31
30	50754	86163	58905	169766	116059	197029	30

# T A B U L Æ

30	Sinum	Tangēium	Secantium				
30	50754	86163	58905	169766	116059	197029	30
31	50779	86148	58944	169653	116079	197032	29
32	50804	86133	58983	169541	116099	196835	28
33	50829	86119	59022	16942	116119	196738	27
34	50854	86104	59061	169315	116139	196641	26
35	50879	86089	59101	169203	116159	196544	25
36	50904	86074	59140	169091	116179	196448	24
37	50929	86059	59179	168979	116199	196351	23
38	50954	86045	59218	168866	116219	196255	22
39	50979	86030	59258	168754	116239	196158	21
40	51004	86015	59297	168643	116259	196061	20
41	51029	86000	59336	168531	116279	195964	19
42	51054	85985	59376	168419	116299	195870	18
43	51079	85970	59415	168308	116319	195774	17
44	51104	85956	59454	168196	116339	195678	16
45	51129	85941	59494	168085	116359	195583	15
46	51154	85926	59533	167974	116380	195487	14
47	51179	85911	59573	167863	116400	195391	13
48	51204	85896	59612	167752	116420	195296	12
49	51229	85881	59651	167641	116440	195201	11
50	51254	85866	59691	167530	116460	195106	10
51	51279	85851	59730	167419	116480	195011	9
52	51304	85836	59770	167309	116501	194916	8
53	51329	85821	59809	167198	116521	194821	7
54	51354	85806	59849	167088	116541	194726	6
55	51379	85792	59888	166978	116562	194632	5
56	51404	85777	59928	166867	116582	194537	4
57	51429	85762	59967	166757	116602	194443	3
58	51454	85747	60007	166647	116623	194349	2
59	51479	85732	60046	166538	116643	194254	1
60	51504	85717	60086	166428	116663	194160	0



# T A B U L Æ

31	Sinuum	Tangētium	Secantium				
0	51504	85717	60086	166428	116663	194160	60
1	51529	85702	60126	166318	116684	194066	59
2	51554	85687	60165	166209	116704	193973	58
3	51579	85672	60205	166099	116725	193879	57
4	51604	85657	60245	165990	116745	193785	56
5	51628	85642	60284	165881	116765	193692	55
6	51653	85627	60324	165772	116786	193598	54
7	51678	85612	60364	165663	116806	193505	53
8	51703	85597	60403	165554	116827	193412	52
9	51728	85582	60443	165445	116848	193319	51
10	51753	85567	60483	165337	116868	193226	50
11	51778	85551	60522	165228	116889	193133	49
12	51803	85536	60562	165120	116909	193040	48
13	51828	85521	60602	165011	116930	192947	47
14	51852	85506	60642	164903	116950	192855	46
15	51877	85491	60681	164795	116971	192762	45
16	51902	85476	60721	164687	116992	192670	44
17	51927	85461	60761	164579	117012	192578	43
18	51952	85446	60801	164471	117033	192486	42
19	51977	85431	60841	164363	117054	192394	41
20	52002	85416	60881	164256	117075	192302	40
21	52026	85401	60921	164148	117095	192210	39
22	52051	85386	60960	164041	117116	192118	38
23	52076	85370	61000	163934	117137	192027	37
24	52101	85355	61040	163826	117158	191935	36
25	52126	85340	61080	163719	117179	191844	35
26	52151	85325	61120	163612	117199	191752	34
27	52175	85310	61160	163505	117220	191661	33
28	52200	85294	61200	163398	117241	191570	32
29	52225	85279	61240	163292	117262	191479	31
30	52250	85264	61280	163185	117283	191388	30

# T A B U L Æ

3)	Sinum	Tangētium	Secantium		
30	52250	85264	61280 163185	117283 191388	30
31	52275	85249	61320 163079	117304 191297	29
32	52299	85234	61360 162972	117325 191207	28
33	52324	85218	61400 162866	117346 191116	27
34	52349	85203	61440 162760	117367 191025	26
35	52374	85188	61480 162654	117388 190935	25
36	52399	85173	61520 162548	117409 190845	24
37	52423	85157	61561 162442	117430 190755	23
38	52448	85142	61601 162336	117451 190665	22
39	52473	85127	61641 162230	117472 190575	21
40	52498	85112	61681 162125	117493 190485	20
41	52522	85096	61721 162019	117514 190395	19
42	52547	85081	61761 161914	117535 190305	18
43	52572	85066	61801 161809	117556 190215	17
44	52597	85051	61842 161703	117577 190126	16
45	52621	85035	61882 161598	117598 190037	15
46	52646	85020	61922 161493	117620 189948	14
47	52671	85005	61962 161388	117641 189858	13
48	52696	84989	62003 161284	117662 189769	12
49	52720	84974	62043 161179	117683 189680	11
50	52745	84959	62083 161074	117704 189591	10
51	52770	84943	62124 160970	117726 189503	9
52	52794	84928	62164 160865	117747 189414	8
53	52819	84913	62204 160761	117768 189325	7
54	52844	84897	62245 160657	117790 189237	6
55	52869	84882	62285 160553	117811 189148	5
56	52893	84866	62325 160449	117832 189060	4
57	52918	84851	62366 160345	117854 188972	3
58	52943	84836	62406 160241	117875 188884	2
59	52967	84820	62446 160137	117896 188796	1
60	52992	84805	62487 160033	117918 188708	0

# T A B U L Æ

32	Sinuum		Tangētium		Secantium		
0	52992	84805	62437	160033	117918	188708	60
1	53017	84789	62527	159930	117939	188620	59
2	53041	84773	62568	159827	117961	188533	58
3	53066	84759	62608	159723	117982	188445	57
4	53091	84743	62649	159620	118004	188357	56
5	53115	84728	62689	159517	118025	188270	55
6	53140	84712	62730	159414	118047	188183	54
7	53164	84697	62770	159311	118068	188095	53
8	53189	84681	62811	159208	118090	188008	52
9	53214	84666	62852	159105	118111	187921	51
10	53238	84650	62892	159002	118133	187834	50
11	53263	84635	62933	158900	118155	187748	49
12	53288	84619	62973	158797	118176	187661	48
13	53312	84604	63014	158695	118198	187574	47
14	53337	84588	63055	158593	118220	187488	46
15	53361	84573	63095	158490	118241	187401	45
16	53386	84557	63136	158388	118263	187315	44
17	53411	84542	63177	158286	118285	187229	43
18	53435	84526	63217	158184	118307	187142	42
19	53460	84511	63258	158083	118328	187056	41
20	53484	84495	63299	157981	118350	186970	40
21	53509	84480	63340	157879	118372	186885	39
22	53534	84464	63380	157778	118394	186799	38
23	53558	84448	63421	157676	118416	186713	37
24	53583	84433	63462	157575	118437	186627	36
25	53607	84417	63503	157474	118459	186542	35
26	53632	84402	63544	157372	118481	186457	34
27	53656	84386	63584	157271	118503	186371	33
28	53681	84370	63625	157170	118525	186286	32
29	53705	84355	63666	157069	118547	186201	31
30	53730	84339	63707	156969	118569	186116	30

# TABULÆ

32	Sinuum		Tangentium		Secantium		
30	53730	84339	63707	156969	118569	186116	30
31	53754	84324	63748	156808	118591	186031	29
32	53779	84308	63789	156767	118613	185946	28
33	53804	84292	63830	156667	118635	185861	27
34	53828	84277	63871	156566	118657	185777	26
35	53853	84261	63912	156466	118679	185692	25
36	53877	84245	63953	156366	118701	185608	24
37	53902	84230	63994	156265	118723	185523	23
38	53926	84214	64035	156165	118745	185439	22
39	53951	84198	64076	156065	118767	185355	21
40	53975	84182	64117	155966	118790	185271	20
41	53999	84167	64158	155866	118812	185187	19
42	54024	84151	64199	155766	118834	185103	18
43	54049	84135	64240	155666	118856	185019	17
44	54073	84120	64281	155567	118878	184935	16
45	54097	84104	64322	155467	118901	184852	15
46	54122	84088	64363	155368	118923	184768	14
47	54146	84072	64404	155269	118945	184685	13
48	54171	84057	64446	155170	118967	184601	12
49	54195	84041	64487	155071	118990	184518	11
50	54220	84025	64528	154972	119012	184435	10
51	54244	84009	64569	154873	119034	184352	9
52	54269	83994	64610	154774	119057	184269	8
53	54293	83978	64652	154675	119079	184186	7
54	54317	83962	64693	154576	119102	184103	6
55	54342	83946	64734	154478	119124	184020	5
56	54366	83930	64775	154379	119146	183938	4
57	54391	83915	64817	154281	119169	183855	3
58	54415	83899	64858	154183	119191	183773	2
59	54439	83883	64899	154085	119214	183690	1
60	54464	83867	64941	153987	119236	183608	0



# T A B U L Æ

33	Sinuum	Tangētium	Secantium	
0	54464	83867	64941 153987	119236 183608 60
1	54488	83851	64982 153888	119259 183526 59
2	54513	83835	65023 153791	119281 183444 58
3	54537	83819	65065 153693	119304 183362 57
4	54561	83804	65106 153595	119327 183280 56
5	54586	83788	65148 153497	119349 183198 55
6	54610	83772	65189 153400	119372 183116 54
7	54635	83756	65231 153302	119394 183034 53
8	54658	83740	65272 153205	119417 182953 52
9	54683	83724	65314 153107	119440 182871 51
10	54708	83708	65355 153010	119463 182790 50
11	54732	83692	65397 152913	119485 182709 49
12	54756	83676	65438 152816	119508 182627 48
13	54781	83661	65480 152719	119531 182546 47
14	54805	83645	65521 152622	119553 182465 46
15	54829	83629	65563 152525	119576 182384 45
16	54854	83613	65604 152429	119599 182303 44
17	54878	83597	65646 152332	119622 182222 43
18	54902	83581	65688 152235	119645 182142 42
19	54927	83565	65729 152139	119668 182061 41
20	54951	83549	65771 152043	119691 181981 40
21	54975	83533	65813 151946	119713 181900 39
22	54999	83517	65854 151850	119736 181820 38
23	55024	83501	65896 151754	119759 181740 37
24	55048	83485	65938 151658	119782 181659 36
25	55072	83469	65980 151562	119805 181579 35
26	55097	83453	66021 151466	119828 181499 34
27	55121	83437	66063 151370	119851 181419 33
28	55145	83421	66105 151274	119874 181340 32
29	55169	83405	66147 151179	119897 181260 31
30	55194	83389	66189 151084	119920 181180 30

# T A B U L Æ

33	Sinum	Tangētium	Secantium				
30	55194	83389	56189	151084	119920	181180	30
31	55218	83373	66230	150988	119944	181101	29
32	55242	83356	66272	150893	119967	181021	28
33	55266	83340	66314	150797	119990	180942	27
34	55291	83324	66356	150702	120013	180862	26
35	55315	83308	66398	150607	120036	180783	25
36	55339	83292	66440	150512	120059	180704	24
37	55363	83276	66482	150417	120083	180625	23
38	55388	83260	66524	150322	120106	180546	22
39	55412	83244	66566	150228	120129	180467	21
40	55436	83228	66608	150133	120152	180388	20
41	55460	83212	66650	150038	120176	180309	19
42	55484	83195	66692	149944	120199	180231	18
43	55509	83179	66734	149849	120222	180152	17
44	55533	83163	66776	149755	120246	180074	16
45	55557	83147	66818	149661	120269	179995	15
46	55581	83131	66860	149566	120292	179917	14
47	55605	83115	66902	149472	120316	179839	13
48	55630	83098	66944	149378	120339	179761	12
49	55654	83082	66986	149284	120363	179682	11
50	55678	83066	67028	149190	120386	179604	10
51	55702	83050	67071	149097	120410	179527	9
52	55726	83034	67113	149003	120433	179449	8
53	55750	83017	67155	148909	120457	179371	7
54	55775	83001	67197	148816	120480	179293	6
55	55799	82985	67239	148722	120504	179216	5
56	55823	82969	67282	148628	120527	179138	4
57	55847	82953	67324	148536	120551	179061	3
58	55871	82936	67366	148442	120575	178984	2
59	55895	82920	67409	148349	120598	178906	1
60	55919	82904	67451	148256	120622	178829	0

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# T A B U L Æ

34	Sinum	Tangētium	Secantium				
0	55919	82904	67451	148256	120622	178829	60
1	55943	82887	67493	148163	120645	178752	59
2	55968	82871	67536	148070	120669	178675	58
3	55992	82855	67578	147977	120693	178598	57
4	56016	82839	67620	147885	120717	178521	56
5	56040	82822	67663	147792	120740	178445	55
6	56064	82806	67705	147699	120764	178368	54
7	56088	82790	67748	147607	120788	178291	53
8	56112	82773	67790	147514	120812	178215	52
9	56136	82757	67832	147422	120836	178138	51
10	56160	82741	67875	147330	120859	178062	50
11	56184	82724	67917	147238	120883	177986	49
12	56208	82708	67960	147146	120907	177910	48
13	56232	82692	68002	147053	120931	177833	47
14	56256	82675	68045	146962	120955	177757	46
15	56280	82659	68088	146870	120979	177681	45
16	56305	82643	68130	146778	121003	177606	44
17	56329	82626	68173	146686	121027	177530	43
18	56353	82611	68215	146594	121051	177454	42
19	56377	82593	68258	146503	121075	177378	41
20	56401	82577	68301	146411	121099	177303	40
21	56425	82561	68343	146320	121123	177227	39
22	56449	82544	68386	146229	121147	177152	38
23	56473	82528	68429	146137	121171	177077	37
24	56497	82511	68471	146046	121195	177002	36
25	56521	82495	68514	145955	121220	176926	35
26	56545	82478	68557	145864	121244	176851	34
27	56569	82462	68600	145773	121268	176776	33
28	56593	82446	68642	145682	121292	176701	32
29	56617	82429	68685	145592	121316	176627	31
30	56641	82413	68728	145501	121341	176552	30

# T A B U L Æ

34	Sinuum	Tangētium	Secantium	
30	56641 82413	68728 145501	121341 176552	30
31	56665 82396	68771 145410	121305 176477	29
32	56689 82380	68814 145320	121389 176402	28
33	56713 82363	68857 145229	121414 176328	27
34	56736 82347	68900 145139	121438 176253	26
35	56760 82330	68942 145048	121462 176179	25
36	56784 82314	68985 144958	121487 176105	24
37	56808 82297	69028 144868	121511 176031	23
38	56832 82281	69071 144778	121535 175956	22
39	56856 82264	69114 144688	121560 175882	21
40	56880 82248	69157 144598	121584 175808	20
41	56904 82231	69200 144508	121609 175734	19
42	56928 82214	69243 144418	121633 175661	18
43	56952 82198	69286 144329	121658 175587	17
44	56976 82181	69329 144239	121682 175513	16
45	57000 82165	69372 144149	121707 175440	15
46	57024 82148	69416 144060	121731 175366	14
47	57047 82132	69459 143970	121756 175293	13
48	57071 82115	69502 143881	121781 175219	12
49	57095 82098	69545 143792	121805 175146	11
50	57119 82082	69588 143703	121830 175073	10
51	57143 82065	69631 143614	121855 175000	9
52	57167 82048	69675 143524	121879 174927	8
53	57191 82032	69718 143436	121904 174854	7
54	57215 82015	69761 143347	121929 174781	6
55	57238 81999	69804 143258	121953 174708	5
56	57262 81982	69847 143169	121978 174635	4
57	57286 81965	69891 143080	122003 174562	3
58	57310 81949	69934 142992	122028 174490	2
59	57334 81932	69977 142903	122053 174417	1
60	57358 81915	70021 142815	122077 174345	0



# TABULÆ

35	Sinum	Tangētium	Secantium
0	57358 81915	70021 142815	122077 174345 60
1	57381 81899	70064 142726	122102 174272 59
2	57405 81882	70107 142638	122127 174200 58
3	57429 81865	70151 142550	122152 174128 57
4	57453 81848	70194 142462	122177 174056 56
5	57477 81832	70238 142374	122202 173983 55
6	57501 81815	70281 142286	122227 173911 54
7	57524 81798	70325 142198	122252 173840 53
8	57548 81782	70368 142110	122277 173768 52
9	57572 81765	70412 142022	122302 173696 51
10	57596 81748	70455 141934	122327 173624 50
11	57619 81731	70499 141847	122352 173552 49
12	57643 81714	70542 141759	122377 173481 48
13	57667 81698	70586 141672	122402 173409 47
14	57691 81681	70629 141584	122428 173338 46
15	57715 81664	70673 141497	122453 173267 45
16	57738 81647	70717 141409	122478 173195 44
17	57762 81631	70760 141322	122503 173124 43
18	57786 81614	70804 141235	122528 173053 42
19	57810 81597	70848 141148	122554 172982 41
20	57833 81580	70891 141061	122579 172911 40
21	57857 81563	70935 140974	122604 172840 39
22	57881 81546	70979 140887	122629 172769 38
23	57904 81530	71023 140800	122655 172698 37
24	57928 81513	71066 140714	122680 172628 36
25	57952 81496	71110 140627	122706 172557 35
26	57976 81479	71154 140540	122731 172487 34
27	57999 81462	71198 140454	122756 172416 33
28	58023 81445	71242 140367	122782 172346 32
29	58047 81428	71285 140281	122807 172275 31
30	58070 81412	71329 140195	122833 172205 30

# TABULÆ

35	Sinum	Tangētium	Secantium	
30	58070 81412	71329 140195	122833 172205	30
31	58094 81395	71373 140109	122858 172135	29
32	58118 81378	71417 140022	122884 172065	28
33	58141 81361	71461 139936	122909 171995	27
34	58165 81344	71505 139850	122935 171925	26
35	58189 81327	71549 139764	122960 171855	25
36	58212 81310	71593 139679	122986 171785	24
37	58236 81293	71637 139593	123012 171715	23
38	58260 81276	71681 139507	123037 171640	22
39	58283 81259	71725 139421	123063 171570	21
40	58307 81242	71769 139336	123089 171506	20
41	58330 81225	71813 139250	123114 171437	19
42	58354 81208	71857 139165	123140 171367	18
43	58378 81191	71901 139079	123166 171298	17
44	58401 81174	71946 138994	123192 171229	16
45	58425 81157	71990 138909	123217 171160	15
46	58449 81140	72034 138824	123243 171091	14
47	58472 81123	72078 138738	123269 171021	13
48	58496 81106	72122 138653	123295 170952	12
49	58519 81089	72166 138568	123321 170884	11
50	58543 81072	72211 138484	123347 170815	10
51	58567 81055	72255 138399	123373 170746	9
52	58590 81038	72299 138314	123399 170677	8
53	58614 81021	72344 138229	123424 170609	7
54	58637 81004	72388 138145	123450 170540	6
55	58661 80987	72432 138060	123476 170472	5
56	58684 80970	72477 137976	123502 170403	4
57	58708 80953	72521 137891	123529 170335	3
58	58731 80936	72565 137807	123555 170267	2
59	58755 80919	72610 137722	123581 170198	1
60	58779 80902	72654 137638	123607 170130	0

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# TABULÆ

36 Sinuum	Tangēium		Secantium				
0	58779	80902	72654	137638	123607	170130	60
1	58802	80885	72699	137554	123633	170002	59
2	58826	80867	72743	137470	123659	169994	58
3	58849	80850	72788	137386	123685	169926	57
4	58873	80833	72832	137302	123711	169858	56
5	58896	80816	72877	137218	123738	169790	55
6	58920	80799	72921	137134	123764	169723	54
7	58943	80782	72966	137050	123790	169655	53
8	58967	80765	73010	136967	123816	169587	52
9	58990	80748	73055	136883	123843	169520	51
10	59014	80730	73100	136800	123869	169452	50
11	59037	80713	73144	136716	123895	169385	49
12	59061	80696	73189	136633	123922	169318	48
13	59084	80679	73234	136549	123948	169250	47
14	59107	80662	73278	136466	123975	169183	46
15	59131	80644	73323	136383	124001	169116	45
16	59154	80627	73368	136300	124028	169049	44
17	59178	80610	73413	136217	124054	168982	43
18	59201	80593	73457	136133	124081	168915	42
19	59225	80576	73502	136051	124107	168848	41
20	59248	80558	73547	135968	124134	168782	40
21	59272	80541	73592	135885	124160	168715	39
22	59295	80524	73637	135802	124187	168648	38
23	59318	80507	73681	135719	124213	168582	37
24	59342	80489	73726	135637	124240	168515	36
25	59365	80472	73771	135554	124267	168449	35
26	59389	80455	73816	135472	124293	168382	34
27	59412	80438	73861	135389	124320	168316	33
28	59436	80420	73906	135307	124347	168250	32
29	59459	80403	73951	135224	124373	168183	31
30	59482	80386	73996	135142	124400	168117	30

# TABULÆ

36	Sinum	Tangētium	Secantium	
30	59482	80386	73996 135142	124400 168117 30
31	59506	80368	74041 135060	124427 168051 29
32	59529	80351	74086 134978	124454 167985 28
33	59552	80334	74131 134896	124481 167919 27
34	59576	80316	74176 134814	124508 167853 26
35	59599	80299	74221 134732	124534 167788 25
36	59623	80282	74267 134650	124561 167722 24
37	59646	80264	74312 134568	124588 167656 23
38	59669	80247	74357 134487	124615 167591 22
39	59693	80230	74402 134405	124642 167525 21
40	59716	80212	74447 134323	124669 167460 20
41	59739	80195	74492 134241	124696 167394 19
42	59763	80178	74538 134160	124723 167329 18
43	59786	80160	74583 134079	124750 167264 17
44	59809	80143	74628 133998	124777 167198 16
45	59832	80125	74674 133916	124804 167133 15
46	59856	80108	74719 133835	124832 167068 14
47	59879	80091	74764 133754	124859 167003 13
48	59902	80073	74810 133673	124886 166938 12
49	59926	80056	74855 133592	124913 166873 11
50	59949	80038	74900 133511	124940 166809 10
51	59972	80021	74946 133430	124967 166744 9
52	59995	80003	74991 133349	124995 166679 8
53	60019	79986	75037 133268	125022 166615 7
54	60042	79968	75082 133187	125049 166550 6
55	60065	79951	75128 133107	125077 166486 5
56	60089	79934	75173 133026	125104 166421 4
57	60112	79916	75219 132946	125131 166357 3
58	60135	79899	75264 132865	125159 166292 2
59	60158	79881	75310 132785	125186 166228 1
60	60181	79864	75355 132704	125214 166164 0

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# TABULÆ

37	Sinum	Tangētium	Secantium
0	60181	79864	75355 132704 125214 166164 60
1	60205	79846	75401 132624 125241 166100 59
2	60228	79829	75447 132544 123269 166036 58
3	60251	79811	75492 132464 125296 165972 57
4	60274	79793	75538 132384 125324 165908 56
5	60298	79776	75584 132304 125351 165844 55
6	60321	79758	75629 132224 125379 165780 54
7	60344	79741	75675 132144 125406 165716 53
8	60367	79723	75721 132064 125434 165653 52
9	60390	79706	75767 131984 125462 165589 51
10	60414	79688	75812 131904 125489 165526 50
11	60437	79671	75858 131825 125517 165462 49
12	60460	79653	75904 131745 125545 165399 48
13	60483	79635	75950 131666 125572 165335 47
14	60506	79618	75996 131586 125600 165272 46
15	60529	79600	76042 131507 125628 165209 45
16	60553	79583	76088 131427 125656 165146 44
17	60576	79565	76134 131348 125683 165083 43
18	60599	79547	76180 131269 125711 165020 42
19	60622	79530	76226 131190 125739 164957 41
20	60645	79512	76272 131110 125767 164894 40
21	60668	79494	76318 131031 125796 164831 39
22	60691	79477	76364 130952 125823 164768 38
23	60714	79459	76410 130873 125851 164705 37
24	60738	79441	76456 130795 125879 164643 36
25	60761	79424	76502 130716 125907 164580 35
26	60784	79406	76548 130637 125935 164518 34
27	60807	79388	76594 130558 125963 164455 33
28	60830	79371	76640 130480 125991 164393 32
29	60853	79353	76686 130401 126019 164330 31
30	60876	79335	76733 130323 126047 164268 30

# T A B U L Æ

37	Sinuum		Tangētium		Secantium		
30	60876	79335	76733	130323	126047	164268	30
31	60899	79318	76779	130244	126075	164206	29
32	60922	79300	76825	130166	126104	164144	28
33	60945	79282	76871	130087	126132	164082	27
34	60968	79264	76918	130009	126160	164019	26
35	60991	79247	76964	129931	126188	163957	25
36	61015	79229	77010	129853	126216	163895	24
37	61038	79211	77057	129775	126245	163834	23
38	61061	79193	77103	129696	126273	163772	22
39	61084	79176	77149	129618	126301	163710	21
40	61107	79158	77196	129541	126330	163648	20
41	61130	79140	77242	129463	126358	163587	19
42	61153	79122	77289	129385	126387	163525	18
43	61176	79105	77335	129307	126416	163464	17
44	61199	79087	77382	129229	126443	163402	16
45	61222	79069	77428	129152	126472	163341	15
46	61245	79051	77475	129074	126500	163279	14
47	61268	79033	77521	128997	126529	163218	13
48	61291	79015	77568	128919	126557	163157	12
49	61314	78998	77615	128842	126586	163096	11
50	61337	78980	77661	128764	126615	163035	10
51	61360	78962	77708	128687	126643	162974	9
52	61383	78944	77754	128610	126672	162913	8
53	61406	78926	77801	128533	126701	162852	7
54	61429	78908	77848	128456	126729	162791	6
55	61451	78891	77895	128379	126758	162730	5
56	61474	78873	77941	128302	126787	162669	4
57	61497	78855	77988	128225	126815	162609	3
58	61520	78837	78035	128148	126844	162548	2
59	61543	78819	78082	128071	126873	162487	1
60	61566	78801	78129	127994	126902	162427	0

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# T A B U L Æ

38	Sinum	Tangētium	Secantium
0	61566 78801	78129 127994	126902 162427 60
1	61589 78783	78175 127917	126931 162366 59
2	61612 78765	78222 127841	126960 162306 58
3	61635 78747	78269 127764	126988 162246 57
4	61658 78729	78316 127688	127017 162185 56
5	61681 78711	78363 127611	127046 162125 55
6	61703 78693	78410 127535	127075 162065 54
7	61726 78676	78457 127458	127104 162005 53
8	61749 78658	78504 127382	127133 161945 52
9	61772 78640	78551 127306	127162 161885 51
10	61795 78622	78598 127230	127191 161825 50
11	61818 78604	78645 127153	127221 161765 49
12	61841 78586	78692 127077	127250 161705 48
13	61864 78568	78739 127001	127279 161646 47
14	61887 78550	78786 126925	127308 161586 46
15	61909 78532	78834 126849	127337 161526 45
16	61932 78514	78881 126774	127366 161467 44
17	61955 78496	78928 126698	127396 161407 43
18	61978 78478	78975 126623	127425 161348 42
19	62001 78460	79022 126546	127454 161288 41
20	62024 78442	79070 126471	127483 161229 40
21	62046 78424	79117 126395	127513 161170 39
22	62069 78405	79164 126319	127542 161111 38
23	62092 78387	79212 126244	127572 161051 37
24	62115 78369	79259 126169	127601 160992 36
25	62138 78351	79306 126093	127630 160933 35
26	62160 78333	79354 126018	127660 160874 34
27	62183 78315	79401 125943	127689 160815 33
28	62206 78297	79449 125867	127719 160756 32
29	62229 78279	79496 125792	127748 160698 31
30	62251 78261	79544 125717	127778 160639 30

# T A B U L Æ

38	Sinum	Tangentium	Secantium	
30	62251 78261	79544 125717	127778 160639	30
31	62274 78243	79591 125642	127807 160580	29
32	62297 78225	79639 125567	127837 160521	28
33	62320 78206	79686 125492	127867 160463	27
34	62342 78188	79734 125417	127896 160404	26
35	62365 78170	79781 125343	127926 160346	25
36	62388 78152	79829 125268	127956 160287	24
37	62411 78134	79877 125193	127985 160229	23
38	62433 78116	79924 125118	128015 160171	22
39	62456 78098	79972 125044	128045 160112	21
40	62479 78079	80020 124969	128075 160054	20
41	62502 78061	80067 124895	128105 159996	19
42	62524 78043	80115 124820	128135 159938	18
43	62547 78025	80163 124746	128165 159880	17
44	62570 78007	80211 124672	128195 159822	16
45	62592 77988	80258 124597	128225 159764	15
46	62615 77970	80306 124523	128254 159706	14
47	62638 77952	80354 124449	128284 159648	13
48	62660 77934	80402 124375	128314 159590	12
49	62683 77916	80450 124301	128344 159533	11
50	62706 77897	80498 124227	128374 159475	10
51	62728 77879	80546 124153	128404 159417	9
52	62751 77861	80594 124080	128434 159361	8
53	62774 77843	80642 124005	128464 159302	7
54	62796 77824	80690 123934	128495 159245	6
55	62819 77806	80738 123858	128525 159188	5
56	62842 77788	80786 123784	128555 159130	4
57	62864 77769	80834 123710	128585 159073	3
58	62887 77751	80882 123637	128615 159016	2
59	62909 77733	80930 123563	128646 158959	1
60	62932 77715	80978 123490	128676 158903	0

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# T A B U L Æ

39	Sinuum		Tangētium		Secantium		
0	62932	77715	80978	123490	128676	158902	60
1	62955	77696	81027	123416	128706	158845	59
2	62977	77678	81075	123343	128737	158788	58
3	63000	77660	81123	123270	128767	158731	57
4	63022	77641	81171	123196	128797	158674	56
5	63045	77623	81220	123123	128828	158617	55
6	63068	77605	81268	123050	128858	158560	54
7	63090	77586	81316	122977	128889	158503	53
8	63113	77568	81364	122904	128919	158447	52
9	63135	77550	81413	122831	128950	158390	51
10	63158	77531	81461	122758	128980	158333	50
11	63180	77513	81510	122685	129011	158277	49
12	63203	77494	81558	122612	129042	158221	48
13	63225	77476	81606	122539	129072	158164	47
14	63248	77458	81655	122467	129103	158108	46
15	63271	77439	81703	122394	129134	158051	45
16	63293	77421	81752	122321	129164	157995	44
17	63316	77402	81800	122249	129195	157939	43
18	63338	77384	81849	122176	129226	157883	42
19	63361	77366	81898	122104	129256	157827	41
20	63383	77347	81946	122031	129287	157771	40
21	63406	77329	81995	121959	129318	157715	39
22	63428	77310	82044	121886	129349	157659	38
23	63451	77292	82092	121814	129380	157603	37
24	63473	77273	82141	121742	129411	157547	36
25	63496	77255	82190	121670	129442	157491	35
26	63518	77236	82238	121598	129473	157436	34
27	63540	77218	82287	121526	129504	157380	33
28	63563	77199	82336	121454	129535	157324	32
29	63585	77181	82385	121382	129566	157269	31
30	63608	77162	82434	121310	129597	157213	30

# T A B U L Æ

39	Sinuum		Tangētium		Secantium		
30	63608	77162	82434	121310	129597	157213	30
31	63630	77144	82482	121238	129628	157158	29
32	63653	77125	82531	121166	129659	157103	28
33	63675	77107	82580	121094	129690	157047	27
34	63698	77088	82629	121023	129721	156992	26
35	63720	77070	82678	120951	129752	156937	25
36	63742	77051	82727	120879	129784	156881	24
37	63765	77033	82776	120808	129815	156826	23
38	63787	77014	82825	120736	129846	156771	22
39	63810	76996	82874	120665	129877	156716	21
40	63832	76977	82923	120593	129909	156661	20
41	63854	76959	82972	120522	129940	156606	19
42	63877	76940	83022	120451	129971	156551	18
43	63899	76921	83071	120379	130003	156497	17
44	63922	76903	83120	120308	130034	156442	16
45	63944	76884	83169	120237	130066	156387	15
46	63966	76865	83218	120166	130097	156332	14
47	63989	76847	83268	120095	130129	156278	13
48	64011	76828	83317	120024	130160	156223	12
49	64033	76810	83366	119953	130192	156169	11
50	64056	76791	83415	119882	130223	156114	10
51	64078	76772	83465	119811	130255	156060	9
52	64100	76754	83514	119740	130287	156005	8
53	64123	76735	83564	119669	130318	155951	7
54	64145	76717	83613	119599	130350	155897	6
55	64167	76698	83662	119528	130382	155843	5
56	64190	76679	83712	119457	130414	155789	4
57	64212	76661	83761	119387	130445	155734	3
58	64234	76642	83811	119316	130477	155680	2
59	64256	76623	83860	119246	130509	155626	1
60	64279	76604	83910	119175	130541	155572	0

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# TABULÆ

40	Sinum	Tangētium	Secantium				
0	64279	76604	83910	119175	130541	155572	60
1	64301	76586	83960	119105	130573	155518	59
2	64323	76567	84009	119035	130605	155465	58
3	64346	76548	84059	118964	130636	155411	57
4	64368	76530	84108	118894	130668	155357	56
5	64390	76511	84158	118824	130700	155303	55
6	64412	76492	84208	118754	130732	155250	54
7	64435	76473	84258	118684	130764	155196	53
8	64457	76455	84307	118614	130796	155143	52
9	64479	76436	84357	118544	130829	155089	51
10	64501	76417	84407	118474	130861	155036	50
11	64524	76398	84457	118404	130893	154982	49
12	64546	76380	84507	118334	130925	154929	48
13	64568	76361	84556	118264	130957	154870	47
14	64590	76342	84606	118194	130989	154822	46
15	64612	76323	84656	118125	131022	154769	45
16	64635	76304	84706	118055	131054	154716	44
17	64657	76286	84756	117986	131086	154663	43
18	64679	76267	84806	117916	131119	154610	42
19	64701	76248	84856	117846	131151	154557	41
20	64723	76229	84906	117777	131183	154504	40
21	64745	76210	84956	117708	131216	154451	39
22	64768	76192	85006	117638	131248	154398	38
23	64790	76173	85057	117569	131281	154345	37
24	64812	76154	85107	117500	131313	154292	36
25	64834	76135	85157	117430	131346	154240	35
26	64856	76116	85207	117361	131378	154187	34
27	64878	76097	85257	117292	131411	154134	33
28	64901	76078	85307	117223	131443	154082	32
29	64923	76059	85353	117154	131476	154029	31
30	64945	76041	85408	117085	131509	153977	30

# T A B U L Æ

40	Sinuum		Tangētium		Secantium		
30	64945	76041	85408	17085	131509	153977	30
31	64967	76022	85458	117016	131541	153924	29
32	64989	76003	85509	116947	131574	153872	28
33	65011	75984	85559	116878	131607	153820	27
34	65033	75965	85609	116809	131640	153768	26
35	65055	75946	85660	116741	131672	153715	25
36	65077	75927	85710	116672	131705	153663	24
37	65099	75908	85761	116603	131738	153611	23
38	65122	75889	85811	116535	131771	153559	22
39	65144	75870	85862	116466	131804	153507	21
40	65166	75851	85912	116398	131837	153455	20
41	65188	75832	85963	116329	131870	153403	19
42	65210	75813	86014	116261	131903	153351	18
43	65232	75794	86064	116192	131936	153299	17
44	65254	75775	86115	116124	131969	153247	16
45	65276	75756	86165	116056	132002	153196	15
46	65298	75738	86216	115987	32035	153144	14
47	65320	75719	86267	115919	132068	153092	13
48	65342	75700	86318	115851	32101	153041	12
49	65364	75680	86368	115783	132134	152989	11
50	65386	75661	86419	115715	132168	152938	10
51	65408	75642	86470	115647	132201	152886	9
52	65430	75623	86521	115579	132234	152835	8
53	65452	75604	86572	115511	132267	152783	7
54	65474	75585	86623	115443	132301	152732	6
55	65496	75566	86674	115375	132334	152681	5
56	65518	75547	86725	115308	132368	152630	4
57	65540	75528	86776	115240	132401	152579	3
58	65562	75509	86827	115172	132434	152527	2
59	65584	75490	86878	115104	132468	152476	1
60	65606	75471	86929	115037	132501	152425	0

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# T A B U L Æ

4)	Sinuum		Tangētium		Secantium		
0	65606	75471	86929	115037	132501	152425	60
1	65628	75452	86980	114969	132535	152374	59
2	65650	75433	87031	114902	132568	152323	58
3	65672	75414	87082	114834	132602	152273	57
4	65694	75395	87133	114767	132636	152222	56
5	65716	75375	87184	114699	132669	152171	55
6	65738	75356	87236	114632	132703	152120	54
7	65759	75337	87287	114565	132737	152069	53
8	65781	75318	87338	114498	132770	152019	52
9	65803	75299	87389	114430	132804	151968	51
10	65825	75280	87441	114363	132838	151918	50
11	65847	75261	87492	114296	132872	151867	49
12	65869	75241	87543	114229	132905	151817	48
13	65891	75222	87595	114162	132939	151766	47
14	65913	75203	87646	114095	132973	151716	46
15	65935	75184	87698	114028	133007	151665	45
16	65956	75165	87749	113961	133041	151615	44
17	65978	75146	87801	113894	133075	151565	43
18	66000	75126	87852	113828	133109	151515	42
19	66022	75107	87904	113761	133143	151465	41
20	66044	75088	87955	113694	133177	151415	40
21	66066	75069	88007	113627	133211	151364	39
22	66088	75050	88059	113561	133245	151314	38
23	66109	75030	88110	113494	133279	151265	37
24	66131	75011	88162	113428	133314	151215	36
25	66153	74992	88214	113361	133348	151165	35
26	66175	74973	88265	113295	133382	151115	34
27	66197	74953	88317	113229	133416	151065	33
28	66218	74934	88369	113162	133451	151015	32
29	66240	74915	88421	113096	133485	150966	31
30	66262	74896	88473	113029	133519	150916	30

# T A B U L Æ

4)	Sinum	Tangētium	Secantium	
30	66262 74896	88473 113029	133519 150916	30
31	66284 74876	88524 112963	133554 150866	29
32	66306 74857	88576 112897	133588 150817	28
33	66327 74838	88628 112831	133622 150767	27
34	66349 74818	88681 112765	133657 150718	26
35	66371 74799	88732 112699	133691 150669	25
36	66393 74780	88784 112633	133726 150619	24
37	66414 74760	88836 112567	133761 150570	23
38	66436 74741	88888 112501	133795 150521	22
39	66458 74722	88940 112435	133830 150471	21
40	66480 74703	88992 112369	133864 150422	20
41	66501 74683	89045 112303	133899 150373	19
42	66523 74664	89097 112238	133934 150324	18
43	66545 74644	89149 112172	133968 150275	17
44	66566 74625	89201 112106	134003 150226	16
45	66588 74606	89253 112041	134038 150177	15
46	66610 74586	89306 111975	134073 150128	14
47	66632 74567	89358 111909	134108 150079	13
48	66653 74548	89410 111844	134142 150030	12
49	66675 74528	89463 111778	134177 149981	11
50	66697 74509	89515 111713	134212 149933	10
51	66718 74489	89567 111648	134247 149884	9
52	66740 74470	89620 111582	134282 149835	8
53	66762 74451	89672 111517	134317 149787	7
54	66783 74431	89725 111452	134352 149738	6
55	66805 74412	89777 111387	134387 149690	5
56	66827 74392	89830 111321	134423 149641	4
57	66848 74373	89883 111256	134458 149593	3
58	66870 74353	89935 111191	134493 149544	2
59	66891 74334	89988 111126	134528 149496	1
60	66913 74314	90040 111061	134563 149448	0

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# TABULÆ

2	sinuum	Tangētium	cantium
1	66935	74295	90093
2	66956	74276	90146
3	66978	74256	90199
4	66999	74237	90251
5	67021	74217	90304
6	67043	74198	90357
7	67064	74178	90410
8	67086	74159	90463
9	67107	74139	90516
10	67129	74120	90568
11	67151	74100	90621
12	67172	74080	90674
13	67194	74061	90727
14	67215	74041	90781
15	67237	74022	90834
16	67258	74002	90887
17	67280	73983	90940
18	67301	73963	90993
19	67323	73944	91046
20	67344	73924	91099
21	67366	73904	91153
22	67387	73885	91206
23	67409	73865	91259
24	67430	73846	91313
25	67452	73826	91366
26	67473	73806	91419
27	67495	73787	91473
28	67516	73767	91526
29	67538	73747	91580
30	67559	73728	91633
			91687
			91740
			91793
			91846
			91900
			91953
			92006
			92060
			92113
			92166
			92220
			92273
			92326
			92380
			92433
			92486
			92540
			92593
			92646
			92700
			92753
			92806
			92860
			92913
			92966
			93020
			93073
			93126
			93180
			93233
			93286
			93340
			93393
			93446
			93500
			93553
			93606
			93660
			93713
			93766
			93820
			93873
			93926
			93980
			94033
			94086
			94140
			94193
			94246
			94300
			94353
			94406
			94460
			94513
			94566
			94620
			94673
			94726
			94780
			94833
			94886
			94940
			94993
			95046
			95100
			95153
			95206
			95260
			95313
			95366
			95420
			95473
			95526
			95580
			95633
			95686
			95740
			95793
			95846
			95900
			95953
			96006
			96060
			96113
			96166
			96220
			96273
			96326
			96380
			96433
			96486
			96540
			96593
			96646
			96700
			96753
			96806
			96860
			96913
			96966
			97020
			97073
			97126
			97180
			97233
			97286
			97340
			97393
			97446
			97500
			97553
			97606
			97660
			97713
			97766
			97820
			97873
			97926
			97980
			98033
			98086
			98140
			98193
			98246
			98300
			98353
			98406
			98460
			98513
			98566
			98620
			98673
			98726
			98780
			98833
			98886
			98940
			98993
			99046
			99100
			99153
			99206
			99260
			99313
			99366
			99420
			99473
			99526
			99580
			99633
			99686
			99740
			99793
			99846
			99900
			99953
			100000

# T A B U L Æ

42	Sinuum		Tangentium		Secantium		
30	67559	73728	91633	109131	135634	148015	30
31	67580	73708	91687	109067	135670	147972	29
32	67602	73688	91740	109003	135707	147925	28
33	67623	73669	91794	108940	135743	147878	27
34	67645	73649	91847	108876	135779	147831	26
35	67666	73629	91901	108813	135815	147784	25
36	67688	73610	91955	108749	135852	147738	24
37	67709	73590	92008	108686	135888	147691	23
38	67730	73570	92062	108622	135924	147644	22
39	67752	73551	92116	108559	135961	147598	21
40	67773	73531	92170	108496	135997	147551	20
41	67795	73511	92223	108432	136034	147504	19
42	67816	73491	92277	108369	136070	147458	18
43	67837	73472	92331	108306	136107	147411	17
44	67859	73452	92385	108243	136143	147365	16
45	67880	73432	92439	108179	136180	147319	15
46	67901	73412	92493	108116	136217	147272	14
47	67923	73393	92547	108053	136253	147226	13
48	67944	73373	92601	107990	136290	147180	12
49	67965	73353	92655	107927	136327	147134	11
50	67987	73333	92709	107864	136363	147087	10
51	68008	73314	92763	107801	136400	147041	9
52	68029	73294	92817	107738	136437	146995	8
53	68051	73274	92872	107676	136474	146949	7
54	68072	73254	92926	107613	136511	146903	6
55	68093	73234	92980	107550	136548	146857	5
56	68115	73215	93034	107487	136585	146811	4
57	68136	73195	93088	107425	136622	146765	3
58	68157	73175	93143	107362	136659	146719	2
59	68179	73155	93197	107299	136696	146674	1
60	68200	73135	93252	107237	136733	146628	0



# TABULÆ

43	Sinuum		Tangētium		Secantium		
0	68100	73135	93252	107237	136733	146628	60
1	68221	73116	93306	107174	136770	146582	59
2	68242	73096	93360	107112	136807	146537	58
3	68264	73076	93415	107049	136844	146491	57
4	68285	73056	93469	106987	136881	146445	56
5	68306	73036	93524	106925	136919	146400	55
6	68327	73016	93578	106862	136956	146354	54
7	68349	72996	93633	106800	136993	146309	53
8	68370	72976	93688	106738	137030	146263	52
9	68391	72957	93742	106676	137068	146218	51
10	68412	72937	93797	106613	137105	146173	50
11	68433	72917	93852	106551	137143	146127	49
12	68455	72897	93906	106489	137180	146082	48
13	68476	72877	93961	106427	137218	146037	47
14	68497	72857	94016	106365	137255	145992	46
15	68518	72837	94071	106303	137293	145946	45
16	68539	72817	94125	106241	137330	145901	44
17	68561	72797	94180	106179	137368	145856	43
18	68582	72777	94235	106117	137406	145811	42
19	68603	72757	94290	106056	137443	145766	41
20	68624	72737	94345	105993	137481	145721	40
21	68645	72717	94400	105932	137519	145676	39
22	68666	72697	94455	105870	137556	145631	38
23	68688	72677	94510	105809	137594	145587	37
24	68709	72657	94565	105747	137632	145542	36
25	68730	72637	94620	105685	137670	145497	35
26	68751	72617	94676	105624	137708	145452	34
27	68772	72597	94731	105562	137746	145408	33
28	68793	72577	94786	105501	137784	145363	32
29	68814	72557	94841	105439	137822	145319	31
30	68835	72537	94896	105378	137860	145274	30

# T A B U L Æ

43	Sinum	Tangentium	Secantium				
30	68835	72537	94896	105378	137860	145274	30
31	68857	72517	94952	105317	137898	145229	29
32	68878	72497	95007	105255	137936	145185	28
33	68899	72477	95062	105194	137974	145141	27
34	68920	72457	95118	105133	138012	145096	26
35	68941	72437	95173	105072	138051	145052	25
36	68962	72417	95229	105010	138089	145007	24
37	68983	72397	95284	104949	138127	144963	23
38	69004	72377	95340	104888	138165	144919	22
39	69025	72357	95395	104827	138204	144875	21
40	69046	72337	95451	104766	138242	144831	20
41	69067	72317	95506	104704	138280	144787	19
42	69088	72297	95562	104644	138319	144742	18
43	69109	72277	95618	104583	138357	144698	17
44	69130	72257	95673	104522	138396	144654	16
45	69151	72236	95729	104461	138434	144610	15
46	69172	72216	95785	104401	138473	144566	14
47	69193	72196	95841	104340	138512	144523	13
48	69214	72176	95897	104279	138550	144479	12
49	69235	72156	95952	104218	138589	144435	11
50	69256	72136	96008	104158	138628	144391	10
51	69277	72116	96064	104097	138666	144347	9
52	69298	72095	96120	104036	138705	144304	8
53	69319	72075	96176	103976	138744	144260	7
54	69340	72055	96232	103915	138783	144216	6
55	69361	72035	96288	103855	138822	144173	5
56	69382	72015	96344	103794	138860	144129	4
57	69403	71995	96400	103734	138899	144086	3
58	69424	71974	96457	103674	138938	144042	2
59	69445	71954	96513	103613	138977	143999	1
60	69466	71934	96569	103553	139016	143956	0

# T A B U L Æ

44	Sinum	Tangētium	Secantium				
0	69466	71934	96569	103553	139016	143956	60
1	69487	71914	96625	103493	139055	143912	59
2	69508	71894	96681	103433	139095	143869	58
3	69529	71873	96738	103372	139134	143826	57
4	69550	71853	96794	103312	139173	143783	56
5	69570	71833	96850	103252	139212	143739	55
6	69591	71813	96907	103192	139251	143696	54
7	69612	71792	96963	103132	139291	143653	53
8	69633	71772	97020	103072	139330	143610	52
9	69654	71752	97076	103012	139369	143567	51
10	69675	71732	97133	102952	139409	143524	50
11	69696	71711	97189	102892	139448	143481	49
12	69717	71691	97246	102832	139487	143438	48
13	69737	71671	97302	102772	139527	143395	47
14	69758	71650	97359	102713	139566	143352	46
15	69779	71630	97416	102653	139606	143309	45
16	69800	71610	97472	102593	139645	143267	44
17	69821	71590	97529	102533	139685	143224	43
18	69842	71569	97586	102474	139725	143181	42
19	69862	71549	97643	102414	139764	143139	41
20	69883	71529	97700	102355	139804	143096	40
21	69904	71508	97756	102295	139844	143053	39
22	69925	71488	97813	102236	139884	143011	38
23	69946	71468	97870	102176	139924	142968	37
24	69966	71447	97927	102117	139963	142926	36
25	69987	71427	97984	102057	140003	142883	35
26	70008	71407	98041	101998	140043	142841	34
27	70029	71386	98098	101939	140083	142799	33
28	70049	71366	98155	101879	140123	142756	32
29	70070	71345	98213	101820	140163	142714	31
30	70091	71325	98270	101761	140203	142672	30

# TABULÆ

44	Sinum	Tangētium	Secantium				
30	70091	71325	98270	101761	140203	142672	30
31	70112	71305	98327	101702	140243	142630	29
32	70132	71284	98384	101642	140283	142587	28
33	70153	71264	98441	101583	140324	142545	27
34	70174	71244	98499	101524	140364	142503	26
35	70195	71223	98556	101465	140404	142461	25
36	70215	71203	98613	101406	140444	142419	24
37	70236	71182	98671	101347	140485	142377	23
38	70257	71162	98728	101288	140525	142335	22
39	70277	71141	98786	101229	140565	142293	21
40	70298	71121	98843	101170	140606	142251	20
41	70319	71100	98901	101112	140646	142209	19
42	70339	7108	98958	101053	140687	142168	18
43	70360	71059	99016	100994	140727	142126	17
44	70381	71039	99073	100935	140768	142084	16
45	70401	71019	99131	100876	140808	142042	15
46	70422	70998	99189	100818	140849	142001	14
47	70443	70978	99247	100759	140890	141959	13
48	70463	70957	99304	100701	140930	141918	12
49	70484	70937	99362	100642	140971	141876	11
50	70505	70916	99420	100583	141012	141835	10
51	70525	70896	99478	100525	141053	141793	9
52	70546	70875	99536	100467	141093	141752	8
53	70567	70855	99594	100408	141134	141710	7
54	70587	70834	99652	100350	141175	141669	6
55	70608	70813	99710	100291	141216	141627	5
56	70628	70793	99768	100233	141257	141580	4
57	70649	70772	99826	100175	141298	141545	3
58	70670	70752	99884	100116	141339	141504	2
59	70690	70731	99942	100058	141380	141463	1
60	70711	70711	100000	100000	141421	141421	0



# SINUS DUORUM

88|

Respectu Radii five

0	9993908	30	9996573
1	9994009	31	9996649
2	9994109	32	9996724
3	9994208	33	9996798
4	9994307	34	9996871
5	9994405	35	9996943
6	9994502	36	9997014
7	9994598	37	9997085
8	9994693	38	9997155
9	9994787	39	9997224
10	9994881	40	9997292
11	9994974	41	9997359
12	9995066	42	9997425
13	9995157	43	9997491
14	9995247	44	9997556
15	9995336	45	9997620
16	9995424	46	9997683
17	9995512	47	9997745
18	9995599	48	9997806
19	9995685	49	9997867
20	9995770	50	9997927
21	9995854	51	9997986
22	9995937	52	9998044
23	9996019	53	9998101
24	9996101	54	9998157
25	9996182	55	9998212
26	9996262	56	9998267
27	9996341	57	9998321
28	9996419	58	9998374
29	9996496	59	9998426
30	9996573	60	9998477

# ULTIMORUM GRADUUM.

89

Sinus Totius 10000000

88-89

0	9998477	30	9999619
1	9998527	31	9999644
2	9998577	32	9999668
3	9998625	33	9999692
4	9998673	34	9999714
5	9998720	35	9999736
6	9998766	36	9999756
7	9998811	37	9999776
8	9998856	38	9999795
9	9998900	39	9999813
10	9998942	40	9999831
11	9998984	41	9999847
12	9999025	42	9999863
13	9999065	43	9999878
14	9999105	44	9999892
15	9999143	45	9999905
16	9999181	46	9999917
17	9999218	47	9999928
18	9999254	48	9999940
19	9999289	49	9999950
20	9999323	50	9999959
21	9999357	51	9999967
22	9999389	52	9999974
23	9999421	53	9999980
24	9999452	54	9999986
25	9999482	55	9999989
26	9999511	56	9999993
27	9999539	57	9999996
28	9999566	58	9999998
29	9999593	59	9999999
30	9999619	60	10000000

# SECANTES DUORUM

o Respectu Radii five

0	10000000	30	10000381
1	10000001	31	10000407
2	10000002	32	10000433
3	10000004	33	10000461
4	10000007	34	10000489
5	10000010	35	10000518
6	10000014	36	10000548
7	10000020	37	10000579
8	10000027	38	10000611
9	10000034	39	10000643
10	10000042	40	10000677
11	10000051	41	10000711
12	10000060	42	10000746
13	10000071	43	10000782
14	10000083	44	10000819
15	10000095	45	10000857
16	10000108	46	10000895
17	10000122	47	10000934
18	10000137	48	10000975
19	10000152	49	10001016
20	10000168	50	10001058
21	10000186	51	10001100
22	10000204	52	10001144
23	10000223	53	10001188
24	10000243	54	10001233
25	10000264	55	10001280
26	10000285	56	10001327
27	10000308	57	10001375
28	10000332	58	10001423
29	10000357	59	10001473
30	10000381	60	10001524

# PRIMORUM GRADUUM.

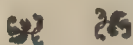
Sinus Totius 100000000.

Jeant

o. l.

0	10001524	30	10003428
1	10001574	31	10003505
2	10001626	32	10003582
3	10001679	33	10003660
4	10001733	34	10003739
5	10001788	35	10003819
6	10001844	36	10003900
7	10001900	37	10003982
8	10001957	38	10004065
9	10002015	39	10004148
10	10002074	40	10004232
11	10002134	41	10004317
12	10002195	42	10004403
13	10002256	43	10004490
14	10002318	44	10004578
15	10002381	45	10004666
16	10002445	46	10004755
17	10002510	47	10004845
18	10002576	48	10004936
19	10002642	49	10005028
20	10002709	50	10005122
21	10002777	51	10005216
22	10002846	52	10005310
23	10002916	53	10005405
24	10002987	54	10005501
25	10003058	55	10005598
26	10003130	56	10005696
27	10003203	57	10005795
28	10003277	58	10005894
29	10003352	59	10005994
30	10003428	60	10006095

FINIS  
TABULARUM.





# TRIGONOMETRIÆ

## CAP. VI.

### De Calculo Triangulorum planorum.

**C**onstructo dispositoque Canone Triangulorum peruenimus tandem ad eorundem calculum, canone mediante subducendum.

II. Nititur is proportione, quam, in Triangulo quocunque, Sinus, Tangentes, & Secantes angularum habent ad Latera, laterumve Sinus, &c.

Laterum Sinus, Tangentes, &c. in sphericis: ipsa Latera in planis.

III. Proportio hac non est continua sed discreta quatuor terminorum, in qua ex tribus notis, quos Data sive dedomena vocamus, elicitur quartus sive Quæsitum.

Calculus itaque totus fit beneficio Regule proportionum quam vulgo Detri vocant, quæq; ex tribus numeris datis elicit quartum quæsitum. Ceterum omne Triangulum 6 terminos habet, tres nimirum angulos, totidemq; latera: de quorum terminorum unius quantitate si questio incidit, ex aliorum trium quantitate data deciditur.

IV. De præcognitione Datorum hæ sunt regule.

I. In Triangulis rectangulis duo tantum requiruntur præter angulum rectum dedomena:

K

ter-

tertiū vicem gerit angulus rectus, cujus finus; qui finus totus sive radius est, in omnium rectangulorum calculo primus proportionis terminus esse facilioremque sola multiplicatione calculum efficere potest.

Et si igitur in analysi rectangulorum etiam alius præter Radium Sinus aut etiam Tangens vel Secans primo proportionis loco usurpari possit: tamen compendiorum & facilitatis amantes tantum eas, ubi res patitur, ad calculum regulas trademus, quæ primo loco Radium habens & consequenter supputationem unica multiplicatione absolvent. Nimirum, ut hoc propter minus assuetos addam, peractâ multiplicatione & characteres dexteri abscinduntur: residui sunt Quotiens quesitus. Abscissi verò sunt numerator fractionis, cujus denominator est finus totus. Hæc fractio in explorandis lateribus planorum neutiquam negligatur, sed in partes popularis mensuræ, cujus est quotiens, redigatur: id quod etiam fiat si præ no loco non radius sed alius quispian numerus adsit. In explorandis autem planorum angulis aut sphericorum tam angulis quam lateribus tantâ præcisione non est opus, saltem attendatur, utrum ista fractio superet semissem: quod si superet, Quotiens augeatur unitate: sin minus, quotiens relinquatur immutatus.

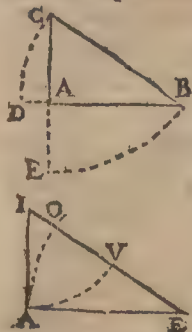
V. 2. In Triangulis rectangulis planis latera singula duplici possunt æstimari mensurâ; unâ populari & ad propositum accommodatâ, alterâ ad partes Radii sive Sinus totius restrictâ.

Ut in Triangulo ABC sit CA ulnarum vel alterius popularis mensuræ 30, AB ejusdem mensuræ 40, BC 50.

Ita sicut hæc latera non ulnarum solummodo mensurâ designari possunt, sed etiam pedum, perticarum &c. sic eadem plani cuiuscunque vel dantur magnitudinis, vel latera

ita alii  
proposunt:  
Latera  
quodvis  
trianguli  
planum  
cuiuscunque  
vel dantur  
magnitudinis  
vel latera

Littera non tantum aliqua harum popularium mensura, sed etiam tali, quæ è Sinu toto oritur, determinare possum. Ut ita quasi duo Triangula videantur, quæ revera unum sunt, diversis tantum mensuris definitum.



VI. 3. In Triangulis rectangulis planis dato uno angulorum acutorum dati sunt omnes anguli.

Per p. 8. c. 3. ejusq. consecut. alter enim acutorum est alterius complementum ad quadrantem sive angulum rectum.

VII. 4. In planis universis, datis duobus angulis quibuscunque dati sunt omnes.

Tertium enim est duorum datorum simul sumtorum complementum ad duos rectos per prop. modò citatam, ejusq. consecut.

VIII. 5. In Triangulis planis æquilateris & æquicruris dato uno quolibet angulorum dati sunt omnes.

In æquilateris enim omnes anguli sunt æquales per p. 14. c. 3. in Æquicruris dato angulo æqualibus cruribus comprehenso, semicomplementum ejus ad duos rectos est reliquorum quilibet per p. 2. c. 3. dato verò reliquorum alterutro, alter huic æqualis est per p. eandem: Tertius amborum simul sumtorum complementum est ad duos rectos per p. 2. c. 3.

IX. In planis universis, unum ad minimum inter tres datos terminos requiritur latus.

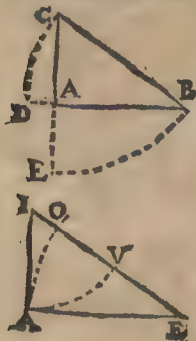
E solis enim tribus angulis datis nullum trianguli plani latus investigari potest propterea quod duo vel plura Triangula sæpè reperiuntur (qualia etiam in omni Trigonometrico calculo supponuntur) quæ penitus æquiangula sunt & tamen lateribus omnino differunt, ut è p. 11. & 13. c. 3. constat.

X. Sequuntur Regulæ proportionum, quibus investigatur terminus quartus: primò quidem in Triangulis planis, post etiam in sphericis.

XI. In utroque Triangulorum genere quædam investigantur directè, quædam indirectè præcedente nimirum quorundam obliquangulorum in bina rectangula sectione.

XII. In Triangulis itaque planis directæ quæsiti supputatio tres habet proportionum regulas, conditionibus terminorum respondentes.

XIII. 1. In Triangulis planis rectangulis si anguli recti basis assumatur ut Radius Circuli sive sinus totus, crus utrumq; fit sinus rectus anguli acuti sibi oppositi. Sin crus alterutrum ex angulo acuto assumatur ut Radius; crus alterum fit acuti sibi oppositi tangens, basis autem ejusdem acuti secans.



Ut in Triangulo ABC si centro B intervallo hypotenuse BC describas arcum CD, mensuram anguli acuti B, vides ad oculum, latus CA fieri

fieri ejusdem acuti sinum rectum; AD, versum: Sic si eodem intervallo ex altero acuto C tanquam centro describas arcum BE mensuram istius acuti C, vides latus BA fieri sinum rectum ejusdem acuti C.

Sin autem non intervallo hypotenusa, sed, velut in  $\triangle AEL$ , intervallo lateris EA centro E describas arcum AO mensuram anguli E, vides I A fieri anguli E tangentem, IE ejusdem anguli secantem: item si ex altero acuto I intervallo I A describas arcum AV, acuti I tangens sit AE, secans IE. Atq; ita hisce triangulis applicatur duplex mensura, popularis scilicet & Geometrica, per p. 5. hujus cap.

#### XIV. Hinc deductio proportionum specialis.

##### Prior:

Vt Sinus Totus Ad sin. alter- Sic hypotenusa Ad latus  
utrius anguli acuti: isti acuto oppositum.

Vt hypotenusa Ad latus re- Sic Sin. Totus Ad Sinum  
liquorum alterutrum: ang. dato lateri oppositi.

Vt Sinus alter- Ad sinum totum: }  
utrius acuti } Sic latus Ad hy-  
Vel per p. 45. c. 4. } acuto op- potenu-  
Vt sinus totus Ad Secant. comple. } positum sam.  
menti hujus acuti: }

##### Posterior:

Vt Sinus Totus Ad Tang. al- Sic latus acuto Ad latus  
terutrius an- isti adjacens dicto acuto  
guli acuti: oppositum.

Vt latus alter- Ad Sin. Tos. Sic latus al- Ad Tang.  
utri acutorum teri acuto anguli huic  
adjacens adjacens lateri op-  
positi.



Ut Tang. alter- Ad sinum totum :

utrius acuti

Vel per p. 42. c. 4.

Ut sinus totus Ad Tang comple

menti huius acuti :

Sic latus Ad latus

acuto op- acuto ad-

positum pccens.

Alternas terminorum permutationes omittimus, ut quas vulgaris etiam Arithmetica studiosus novit.

Quibus autem Datis aut Quæstis singule proportionales applicande sint, ipse sunt indicio. Semper enim Data occupant tres priores proportionum terminos, Quæsitum autem quartum. Exemplum unicum addemus. In Triangulo  $ABC$  sunt data præter angulum rectum ad  $A$  hypotenusa  $BC$  50 pedum, cum acuto ad  $B$  36 gr. 52 m. 12 sec. quaratur autem latus  $AC$ . Dati anguli sinus per p. 15. c. præc. limitatus est 60000. Fiat igitur

Ut Radius Ad sinum Sic hypotenusa

100000 — 60000 ——— 50 ———

Operatione peracta proveniunt 30 pro latere  $AC$  quæso.

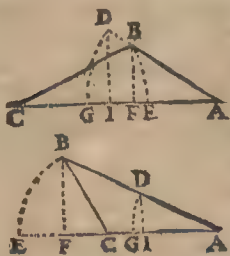
N. Præctica quam vocant Italica sive diminutio terminorum proportionum, si quando haberi possit, non minus hic locum habet ac in Arithmetica vulgari. Ut in nostro exemplo vel sic termini consistere possant: 10000. 60000 5. vel ita: 10. 6. 50. 1. 6. 5.

XV. 2. In triangulis planis universis Latera sinibus oppositorum angulorum directe sunt proportionalia.

Directè, hoc est, Ut sinus anguli ad latus ei oppositum, sic sinus alterius anguli ad latus huic oppositum, vel alternd; non autem reciproce, Ut sinus anguli ad latus oppositum, sic latus aliud ad angulum oppositum. Caterum directè hæc

pra-

proportio manifesta est in rectangulis, ut è præced. proposi-  
tione constat: ibi enim erat ut sinus anguli recti ad hypotenusam  
sive latus oppositum, sic sinus anguli acuti ad latus oppositum;  
& inverse: item ut sinus acuti ad l. oppositum, sic sinus al-  
terius acuti ad l. iidem oppositum; & inverse.



In obliquangulis hæc proportio  
sic demonstratur. Ad angulum A  
statuatur AD equalis lateri BC,  
eodem intervallo ducatur arcus  
DG, cujus sinus demittatur DI.  
Tum etiam ex angulo C intervallo  
lateris CB (eodem quo prius) du-  
catur arcus BE cujusq. sinus BF.  
Iam igitur in  $\triangle$ is rectangulis A

DI & ABF propter rectos ad I & F & propter commu-  
nem ad A similibus erit per p. 13. c. 3. Ut AB ad BF sinum  
anguli C: sic AD (cui per structuram æquatur BC) ad DI  
sinum anguli A, & inverse. Latera igitur AB & BC propor-  
tionalia sunt sinibus oppositorum angulorum.

**XVI.** Hinc deductio proportionum specialis:

Ut sinus an. Ad latus oppo. Sic sinus alte- Ad latus iid.  
guli alicujus situm: rius anguli oppositum.

Ut Latus ali- Ad sinum ang. Sic latus aliud Ad sinum ang.  
quod oppositi: iid. oppositi.

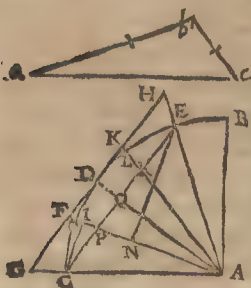
Exemplum: esto latus BC partium 25, angulus A 34.  
gr. 30 m. angulus B 120 gr. 42 m. queratur autem latus A  
C. Calculus talis est:

Sinus ang. A.	Latus oppos. BC	Sinus ang. B
56641	25	85985

idem scil. cum sinu 59. gr. 18. m. per 1. confect. p. 23. c. 4.

Operatione peractâ proveniunt  $37\frac{11908}{10641}$  quæ manifestat  
 latus AC quæsitum. Quod si latus BC sit 25 perticarum,  
 erit AC perticarum 37, & fractio æquivalens plusquam  
 14 pedibus.

XVII. 3. In Triangulis planis universis Ut  
 summa laterum angulum notum comprehen-  
 dentium est ad eorundem laterum differenti-  
 am: sic tangens dimidiæ ignotorum angulorum  
 summx est ad tangentem differentix, quæ mi-  
 nor ignotorum à dimidia summa deficit, major  
 eam superat.



In Triangulo  $abc$  nota sint  
 duo latera  $ab$  &  $bc$  cum an-  
 gulo ab ipsis comprehenso, re-  
 liquis angulis ad  $a$  &  $c$  cum la-  
 tere interjecto ignotis. Dico,  
 ut summa laterum  $ab$  &  $bc$  ad  
 eorundem differentiam est, ita  
 dimidiæ reliquorum ad  $a$  &  $c$   
 angulorum summa (quæ sum-  
 ma est complementum anguli  
 dati ad duos rectos per p. 8. c.

3.) tangentem esse ad tangentem differentie anguli minoris  
 quidem infra dimidiam summam, majoris autem supra. Ad  
 quæ demonstranda descripto Quadrante ABC, statuatur  
 in eundem angulus CAO aequalis angulo ad  $a$ , & OAE  
 aequalis alteri ad  $c$ , ut in quadrante angulus CAE vel ar-  
 cus CE fiat summa angulorum  $a$  &  $c$  Trianguli propositi.  
 Subtensa hujus summx sit recta CE. Bisecetur hæc summa,  
 ut semâsis sit CD vel DE, cujus tangentes DG & DH.

Demit-

Demittantur etiam Sinus, EN anguli majoris & CI minoris. Defectus minoris à dimidia summa vel excessus majoris supra eandem est arcus OD vel angulus OAD, cui ponatur equalis DL vel DAL, quorum tangens D. F vel DK. Iam in Triangulis ICP & PEN ad I & N per 22.c.4. rectangulis & propter eosdem rectos ac verticales ad P itemq; alternos ad C & E equiangulis, eria per p.13.c.3. ut IC ad CP sic NE ad EP. Ergo per 15 huius c. laterum CP & EP ad Sinus CI & EN eadem est ratio que laterum a b & b c ad sinus oppositorum angulorum: ac proinde quicquid demonstratur de rectis CP & EP, idem etiam locum habet in lateribus a b & b c. Sic igitur CPE est laterum summa, PR differentia, (nam RE & CP per structuram sunt equales) cuius semissis PQ vel QR. Triangula porro HAD & EAQ, item KAD & RAQ, item HAG & EAC &c. similia sunt propter communes angulos ad A & propter rectas HG & EC per 40.c.4. parallelas: ideoque ut CE quasi summa laterum a b & b c ad PR (laterum differentiam) sic GH (dupla tangens dimidiæ angulorum CAO & OAE summa) ad FK (duplam tangentem differentie OD vel DL anguli majoris supra vel minoris infra dimidiam summam). Et ut QE ad QR, sic DH ad DK: Ergo etiam ut CE ad PR sic DH ad DK: hoc est, ut summa laterum ad differentiam laterum, sic DH tangens dimidiæ angulorum summa ad DK tangentem differentie angulorum supra vel infra dimidiam summam. Quod si igitur hanc differentiam inventam OD jungas dimidiæ angulorum summa DE, habebis angulum quesitum maiorem OE vel OAE; sin subtrahas, habebis minorem CO. et CAO.

Exemplum: Est lat<sup>us</sup>  $a$   $b$  21 cubit.  $b$   $c$  10. angulus inclusus 110 gr. 20 m. Numerorum locatio talis erit:

		Duo recti	179 60
		Ang. datus	110 20
$a$ $b$ 21	— — — 21		
$b$ $c$ 10	— — — 10	Summa reliq.	69 40.
		Cujus Semiss.	34 50.
Sum. 31	— Diff. 11.	— Tang	69588.

Operatione peracta provenit 24692 tangens 13 gr. 52 m. 12 sec. que ab usurpata dimidia ignotorum angulorum summa 34 gr. 50 m. subtrahita relinquunt angulum a 20 gr. 57 m. 48 sec. addita vero isti dimidie summa producit angulum ad  $c$  48 gr. 42 m. 12 sec. Hac regula proportionum constructa sunt in Astronomia tabule prosthaphæresum planetariarum & parallaxium altitudinis, ut lib. 3. Astronomiæ nostræ suis locis videre est. Vsum etiam eius aliquem monstrabimus infra in dimetienda longitudine, ad cuius neutrum terminum datur accessus.

XVIII. Sic fuerunt proportionales calculi planorum directi: calculus indirectus, qui scilicet institui nequit ante sectionem trianguli obliquanguli scaleni in duo rectangula, sic cum tria Trianguli data sunt mera latera, nullus angulus; unus autem angulorum quasiu necessarius est.

XIX. Sectio sic perpendiculari in latus maximum ex angulo opposito demissa; que quantum faciat utrumq. lateris maximi segmentum, docet hac parascévastica proportio: Vt latus maximum est ad reliquorum laterum summam, sic eorundem laterum differentia est ad lateris maximi segmen-



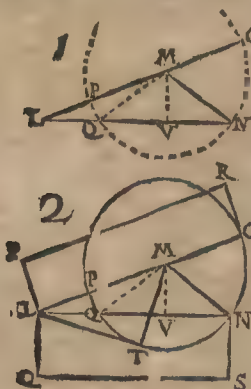
rum, quo reſecto, reſidui medium eſt punctum inco-  
dentie perpendiculari.

Hac proportio extraordinaria eſt, que nempe non la-  
terilis mixtim ac ſinibus vel tangemibus &c. conſtat ſed  
meris lateribus eorumq; ſegmentis. Eſtq; tantum paraſce-  
vaſtica ad principalem calculum, dum  $\Delta$ lo obliquangulo in  
duo reſt angula diremito dedomena trigonometrica ad an-  
gulos explorandos neceſſaria manifeſtat.

Pag. ſeq.  $\Delta$ lum  $L M N$ , cujus omnia tria latera, nullus  
angulus, noti ſint, perpendicularo  $M V$  ex angulo maximo  $M$   
deſiſſo in latus maximum  $LN$ , dirimitur in duo Triangula  
reſt angula  $L M V$ , &  $N M V$ : Queritur quanta ſit  $L V$  &  
quanta  $V N$ , adeoque locus puncti  $V$  in tota  $LN$ . Dicit  
autem Regula in  $\Delta$ lo  $L M N$  eſſe ut  $L N$  latus maximum  
ad  $L M$  &  $M N$  ſive (circulo ex  $M$  intervallo lateris mini-  
mi deſcripto) ad  $L M O$  reliquorum laterum ſumma, &  
ſic  $L P$  differentiam horum laterum ad  $L Q$  quo reſecto re-  
ſiduum ac latere maximo eſt  $Q N$ : huius dimidium  
eſſe  $Q R$  vel  $R N$ . Ad hec demonſtranda ſiant primum  
duo parallelogramma reſt angula, unum  $L N S Q$  ex la-  
tere maximo  $LN$  & ejus ſegmento  $L Q$ , alterum  $L O R P$   
ex laterum reliquorum ſumma  $LO$  & eorum differentia  
 $LP$ . Ex  $L$  deinde ducatur  $LT$  circulum tangens, & ad  
punctum contactus  $T$  radius  $MT$  efficiens cum  $LT$  &  $LM$   
 $\Delta$ lum  $L M T$  per p. 15. c. 2. reſt angulum ad  $T$ . Quo facto  
coſtat reſtam  $PMO$  biſectam in  $M$  & continuatam in  $L$ . Iam  
per p. 9. c. 2. oblongum eſt tota  $OL$  & continuatione  $P L$  ad  
cum quadrato ex  $PM$  (cui aequatur  $MT$ ) ſimul ſumma equalia  
ſunt quadrato ex  $LM$ : eidem etiam quadrato equalia ſunt  
quadrata reſtarum  $LT$  &  $TM$  ſive  $PM$  per p. 20. c. 3.

unde

unde sequitur oblongum  $PLOR$  equari quadrato rectæ  $LT$ .



Eidem quadrato rectæ  $LT$  etiam æquatur oblongum  $LN SQ$ : nam rectâ  $QN$  bisectâ in  $V$  & continuatâ ad  $L$  oblongum ex  $NL$  &  $LQ$  unâ cum quadrato ex  $QV$  æquatur quadrato rectæ  $LV$ : porro cum angulus ad  $V$  per structuram sit rectus, idcirco  $\square$  rectarum  $QV$  &  $VM$  conficiunt quadratum rectæ  $QM$  cui æquatur  $TM$ , quadrata verò re-

ctarum  $LV$  &  $VM$  conficiunt quadratum rectæ  $LM$ : consequenter oblongum  $LNSQ$  cum quadratis  $QV$  &  $VM$  (hoc est quadrato  $QM$  vel  $TM$ ) conficit quadratum rectæ  $LM$ . Si igitur oblongum cum quadrato  $TM$  æquatur quadrato  $LM$ , cui quadrato per p. 20. c. 3. æquantur quadrata  $LT$  &  $TM$ , necessarid quadratum rectæ  $LT$  æquatur oblongo  $LNSQ$ . Antea verò demonstratum est etiam alterum oblongum huic quadrato æquari: ergo oblonga hæc inter se sunt æqualia: & per consequens habebunt latera per conf. 3. p. 16. c. 2. reciproce proportionalia, hoc est, sicut se habet  $NL$  longitudo prioris ad  $LO$  longitudinem posterioris, ita  $LP$  latitudo posterioris ad  $LQ$  latitudinem prioris: quod erat demonstrandum. Porro residuum  $QN$  à perpendiculari  $MV$  bisecari in  $V$  manifestum est è p. 10. c. 4.

*XX.* Cognito sectionis puncto, *Ve* segmentum resectum cum semisse residui est ad latus segmen-

eo adjacens, item ut sola residui semissis est ad latus semissi adjacens; ita Sinus totus est ad secantem anguli lineis usurpatis comprehensi.

Hoc est, ut LV ad latus LM, sic LV sinus totus ad LM secantem anguli L. per p. 13. & 14. Item ut VN ad latus NM, sic VN sinus totus ad NM secantem anguli N.

Estonunc, ut exemplum addamus, LN partium 73, LM 50, MN 34, è quibus datis eruendi sint anguli exerciti gratia omnes. Prius pro puncto V adeoque segmentis LV & VN calculus talis est:

$$\begin{array}{r} \text{LM } 50 \quad \text{LM } 50 \\ \text{MN } 34 \quad \text{MN } 34 \\ \hline \end{array}$$

LN 73 — Sum. 84 — Diff. 16. Operatione peracta Quotiens est  $18\frac{10}{71}$ . segmentum scilicet LQ. Quod subtractum de tota LN 73 relinquit QN  $54\frac{43}{71}$ . Igitur QV vel VN evadit  $27\frac{43}{142}$ . Deinde pro angulis explorandis dico: Vt VN  $27\frac{43}{142}$  ad NM 34, sic 1000000 ad 124567 secantem anguli N 36 gr. 36 min. 13 sec. Et: Vt LV  $45\frac{103}{142}$  ad LM 50, sic 1000000 ad 109396 secantem anguli L 23 gr 55 min. 13 sec. Tertius angulus est horum duorum inventorum simul sumtorum complementum ad duos rectos per conf. 2. p. 8. c. 3.

Angulus N  $36^{\circ} 36' 13''$ .

Angulus L  $23^{\circ} 55' 13''$ .

Summa 60 31 26. Subt. .

Duo recti 179 59 60. id est, 180.

Angulus M 119 28 34.

Potes

Potest etiam uno angulo per hanc regulam explorato  
 alter explorari (& quidem in hoc exemplo facilius: evita-  
 tur enim fractio) per regulam precedentem. Datis enim  
 in Triangulo LMN duobus lateribus, LN 73 & MN 34  
 cum angulo 36 gr. 36 min. 13 sec. ab illis comprehen-  
 so angulum L sic peruestigo:

			Duo ang. recti	179	59	60
			Angulus N	36	36	13 Subt.
I. N	73	73	Summa reliq.	143	23	47
M N	34	34	Semissis	71	41	53 Cujus
Sum. 107.		Diff. 39	Tangens 302340.			

Operatione peracta provenit 110° 19' 8". Tang. 47 gr.  
 46 min. 39 sec.

Semissis sum. ang. L & M	71	41	53	71	41	53
Arcus differentia	47	46	39 Subt.	47	46	39 Add.

Angulus obtusus M 119 28 33. Acut. L 23 55 14.

XXI. His quatuor proportionum regulis & a-  
 liis paucis priorum capp. theorematibus, omnia in  
 quocunque Triangulo plano quaesita reperiuntur, si  
 modo tres termini proportionis debiti iusto modo  
 decur. Id quod est subiecta calculi tabella videre est.

IN TRIANGULO RECTAN-  
 gulo inveniuntur

HYPOTENUSA

Ex lateribus reliquis:

Quadrata laterum adduntur: summa radix quadra-  
 ta est hypotenusa quaesita, per cons. p. 20. c. 3.

Ex alterutro latere cum angulis:

(Dato uno angulorum dati sunt omnes per 6. huius c.)

Ut Radius Ad secant. ang. Sic lat. datum Ad hypot. qua-  
 dato lateri adjacens: sit. Per 13. b.

CAP. VI.  
LATUS ANG. RECTO  
ADIACENS

167

E lateribus reliquis:

Quadrata laterum ab invicem subtrahuntur: differē-  
rentie pve residui radix quadrata est latus quæsitum. per  
conf. p 20. c. 3. Ex angulis & hypotenusa:

Vt Radius Ad sinum an. Sic hypotenusa Ad lat. quæsit.  
guli quæsit. lateri opp. per p. 13. h. c.

Ex angulis & altero latere:

Vt Radius Ad Tang. an. Sic latus da. Ad latus qua-  
quæsit. guli dato late- tum situm.  
ri oppositi: per 13. hujus.

ANGULI

E lateribus ang rectum includentibus:

Vt latus an. Ad latus reli. Ita Sinus totus Ad tang. anguli  
gulo quæsit. quum: li quæsit.  
adjacens per 13. hujus.

Ex hypotenusa & latere quæsit  
angulo opposito:

Vt hypotenusa Ad latus da. Ita sinus totus, Ad sinum an-  
tum reliquum: guli quæsit.  
per 13. hujus.

IN TRIANGULO OBLI-  
quangulo reperiuntur

LATERA

Ex angulis & uno latere:

(Datis duobus angulis dati sunt omnes, per p. 7. h. c.)

Vt sinus an. Ad latus da. Sic sinus anguli Ad latus qua-  
guli dato lateri tum: quæsit. lat. op. situm.  
oppositi positi per p. 15. h. c.

ANGULI



# TRIGONOMETRIÆ ANGULI

E duobus lateribus & angulo illis comprehenso:

Ut summa Ad eorundem Sic tangens di Ad tang. arcum  
datorum differentiam: media ignotor. usurpata di-  
laterum ang. summa medie summa  
addendi, ut prodeat angulus quesitus major; aut subtra-  
rahendi, ut prodeat minor. Per p. 17. hujus c. Is autem an-  
gulus major est, qui majori lateri opponitur; minor autem,  
qui minori, per p. 24. c. 1.

Si  $\Delta$ lum sit *Æquilaterum* aut *Æquicrurum*, dato uno  
angulorum noti sunt omnes per p. 8. hujus c.

E duobus lateribus & angulo illis non  
comprehenso:

Ut latus an- Ad anguli da- Sic latus an- Ad sinum an-  
gulo dato op- ti sinum: gulo quesito guli quesiti, si  
positum oppositum is debeat acu-  
tus esse; sin requiratur obtusus, anguli inventi complemen-  
tum ad duos rectos demum est angulus quesitus. per p. 15.  
hujus c.

Si  $\Delta$ lum sit *Æquilaterum* aut *Æquicrurum*, dato uno  
angulorum noti sunt omnes per p. 8. hujus c.

Ex omnibus lateribus:

Ut latus ma. Ad reliquorū Sic eorundem Ad lateris mi-  
ximum summam: differentia ximi segmen-  
tum, quo subtracto residui medium est punctum incidentie  
perpendiculari. Tumq̃

Vere residui se- Ad latus mi- Sic Sinus to- Ad secant an-  
missus nus: tus guli minori la-  
teri adjacentis. ut:

*Ut residui* *Ad latus ma-* *Ita Sinus* *Ad secant. ang.*  
*semis una* *jus:* *Totus* *majori lateri*  
*cum subira-*   *adjacentis.*  
*cto segmento*   *per 18 & 19.*  
   *hujus c.*

*Si Triangulum sit æquilaterum aut æquicrurum; erit absque inquisitione perpendiculari*

*Ut Sinus basis* *Ad crus alter-* *Sic sinus totus* *Ad secant. al-*  
*utrum:* *utrum:* *terutrinus æ-*  
  *qualium ad*  
  *basin angulor.*

*Tertius angulus est duorum inventorum complement. ad duos rector.*

## CAP. VII.

De calculo Triangulorum  
sphæricorum.

*I. Calculus Triangulorum sphæricorum ad ea potissimum restringitur, quorum latera vel omnia vel ad minimum duo principalia, datum scilicet aut quesitum angulum comprehendencia, sigillatim sunt quadrantibus minora.*

*Et si quidem regule proportionum aliis etiam  $\Delta$ lis conveniant, tamen commodius adhibentur modò dictis: id quod primò omnium Logista notes.*

*II. In vel quis triangulis aut ipsa se quesita produnt absque calculo, aut resolutione Trianguli oppositi inveniuntur.*

L

II I. Prio-

III. Prioris generis sunt rectangula plurimum rectorum: ubi latera rectos subtendentia sunt quadrantes, tertium autem latus est oppositi acuti mensura.

In Triangulo rectangulo nunquam dantur soli anguli recti, sed unus etiam obliquus: nisi omnes sint recti. Vide de rectangulorum generibus propp. ultimas c. 3.

IV. Posterioris generis sunt rectangula & obliquangula duorum obtusorum, adeoque laterum obtusis oppositorum quadrantibus majorum: cum etiam rectangula unius obtusi, alterius acuti.

V. In his innoscunt quæ sita resolutione Triangulorum oppositorum, basin cum dato communem obtinentium. Dato quidem Triangulo cum duobus obtusis resolvitur oppositum cum duobus aut omnibus acutis: Dato etiam rectangulo cum uno obtuso & altero acuto, resolvitur rectangulum cum duobus acutis ex acuti dati regione oppositum. Basis enim oppositorum angulorum communis est & anguli utrinque basi oppositi sunt æquales: reliquorum per calculum inventorum complementa ad semicirculum manifestant quæ sita.

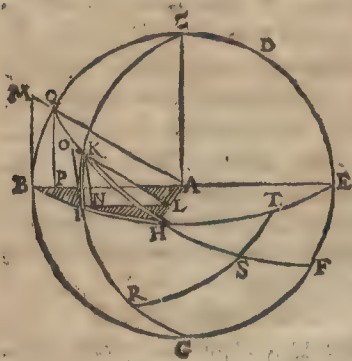
Per p. 23. c. 3. Vbi etiam exemplum oppositionis habetur, quamquam illud non est huius loci. Assumamus autem propter minus exercitatos è sphaera mundi arcum Eclipticæ à principio ♈ secundum seriem signi usq; ad principium ♎, ac inde arcum æquatoris à principio ♈ ad punctum, in quod perpendicularis à principio ♎ demissa incidit, estq; ea  
per-

pendicularis latus tertium, designans declinationem principii  $\Omega$  20 gr. 13 m. 22 sec. angulus huic lateri oppositus est angulus intersectionis  $\text{\AA}$ equatoris & Eclipticae 23 gr. 3 1' m. angulus eodem latere &  $\text{\AA}$ equatore interceptus est rectus, quia latus incidit perpendiculariter: tertius angulus ad Eclipticam est obtusus: latera angulo recto & obtuso opposita singula sunt quadrante majora; nam quod ab Ecliptica constituitur, continet gradus 120, quod ab  $\text{\AA}$ equatore, adhuc paulo plures, per p. 24 c. 1. Istud autem latus esto, de quo queratur, nempe Ascensio recta principii  $\Omega$  Huic igitur Triangulo rectangulo opponitur aliud minus, cujus basis cum priori communis est, nempe declinatio principii  $\Omega$ : angulus ipsi oppositus est acutus & aequalis etiam angulo acuto trianguli majoris, nempe 23 gr. 3 1' min. reliqua latera sunt priorum complementa ad semicirculum: concurrunt enim ad principium  $\triangle$ , estq. hypotenusa quidem 60 grad. lateris tertii quantitas queritur. Invenietur autem in exemplis pag. 179. 57 gr. 48 min 6 sec. Hujus ergo complementum ad semicirculum 122 gr. 11 min. 54 sec. est Ascensio recta principii  $\Omega$  sive latus  $\Delta$ li majoris questum, arcus scilicet  $\text{\AA}$ equatoris à principio  $\Omega$  ad communem  $\Delta$ lorum basin.

V I. Triangulorum igitur cum duobus acutis adeoque duobus lateribus singulatim quadrante minoribus, non secus ac planorum, quaedam directe quaedam indirecte, quatenus nimirum prius in duo rectangula secantur, resolvuntur.

V II. Directa Quasiri supputatio 4 habet proportionum regulas, datorum conditionibus respondentes, L 2 V III. Si

VIII. 1. Si Trianguli sphærici cum duobus acutis reſtanguli latera angula quadrante-tenus continuentur, & quadrantum illorum termini quadrante quarto connectantur, fiunt duo Triangula reſtangula eodem acuto deſi-  
nencia: in quibus ſinus hypotenuſarum ſinibus laterum communi acuto oppoſitorum directe ſunt proportionales.



Sit hemisphærium  
BCDEFG cen-  
tri A, & in ejus ſu-  
perficie Triangulum  
HIK reſtangulum  
ad I cum acutis ad  
H & K. Continuatis  
omnibus lateribus ad  
quadrantem, HI  
ſcilicet in B, HK  
in Q, IK in C, ter-  
mini BQC con-

nectantur (ut hoc loco jam connexi ſunt) quadrante quarto  
CQB, fit jam adhuc unum triangulum HBQ uidem  
reſtangulum, quadrans enim CQB tranſit per Circuli  
BIHE polum C, igitur ei per p. 18.c. 2. perpendicu-  
laris eſt non ſecus atque quadrans CKI: deſinunt autem  
hec duo Triangula BQH & IKH in eundem acutum  
H, ut manifeſto apparet. Dico ergo in his duobus  $\Delta$ lis  
eſſe ut AQ ſinus reſtus hypotenuſe HQ trianguli maj. ris,  
(quo hyp. ut ſemper quadrans eſt, ita ſinus ejus ſemper ſinus  
totus eſt per conf. 2. prop. 23.c. 4.) ad LK ſinum reſtum hy-  
potenufa



potentia HK  $\Delta$ li minoris; ita QP sinum lateris QB  $\Delta$ li majoris, ad KN sinum lateris KI  $\Delta$ li minoris, lateris inquam utriusque communi acuto H oppositi. Quia namque planum Circuli QKHSF undique equaliter ad planum circuli BIHTE inclinatum est, erunt sinus AQ & LK, utpote in eoaem plano jacentes, paralleli, nec ob hoc solum causam sed etiam per p. 24. c. 4. Similiter paralleli sunt sinus QP & KN per p. eandem. Ob hanc equalitatem inclinationem erunt in Triangulis planis APQ & LNK anguli ad P & N recti & ad L & A equales, adeoque ipsi Triangula per p. 11. c. 3. similia sunt, & per p. 13. ejusdem c. est ut AQ ad QP, sic LK ad KN; vel alternè ut AQ ad LK, sic QP ad KN: & inversè ut NK ad KL, sic PQA ad QA; vel alternè: & conversè ut LK ad KN, sic AQ ad QP; vel alternè. Sinus igitur AQ & LK hypotensarum HQ & HK sinibus QP & KN laterum QB & KI communi acuto oppositorum directè sunt proportionales.

Idem demonstrari potest si in assumpto Triangulo HIK assumatur aliter acutus ad K, & latera continuentur KH in S, KI in R, & IH in T, quadrantumque IHT, KHS, & KIR termini connectantur quadrante quarto TSR. Fiunt enim & hic duo  $\Delta$ la IKH, RKS rectangula ad I & R, communi acuto ad K. Sed proximitatem & linearum confusionem evitaturi speramus philomathen priori demonstratione contentum. Juniores attendant, non tantum AQ vel AB esse radios sphaerae, sed etiam AH: ei temque radio AH non tantum perpendicularares esse QA & KL, sed etiam PA & NL. AH enim quia communis sectio adeoque radius est Circulorum QKHSF & BIHTE, proinde

quatenus  $AH$  est radius Circuli prioris, perpendiculares ei sunt  $QA$  &  $OL$  in plano istius Circuli: quatenus autem est radius circuli posterioris, perpendiculares ei sunt  $PA$  &  $NL$  in plano huius Circuli, quod planum in tyronum gratiam lineamentis picturis à priori distinximus.

*IX. Hinc deductio proportionum specialis, in Triangulo cum duobus acutis rectangulo quocunq̃:*

*Ut Radius Ad sinum hypo- sic sinus al Ad sinum la-  
potenusa: terusius a- teris oppositi.  
cuti,*

*Ut sinus hypo- Ad Radium  
potenusa*

*Vel per 45. c. 4.*

*Ut Radius Ad secantem  
complementi  
hypotenusa:*

*Ut sin. alteru- Ad Radium  
trius acuti*

*vel per 45. c. 4.*

*Ut Radius Ad secantem  
compl. alteru-  
trius acuti*

*Sic sinus lato- Ad sinum an-  
ri alterius guli oppositi.*

*sic sinus lato- Ad sinum hy-  
ris acuto op- potenusa.  
positi*

Omnia per superiorem demonstrationem; si modò no-  
tetur, sinum hypotenusa majoris  $\Delta li$  esse sinum totum sive  
radium; & latus  $QB$  m. joris  $\Delta li$  esse mensuram anguli  
acuti ad  $H$ , siquidem  $HQ$  &  $HB$  quadrantes sunt: quic-  
quia igitur de sinu anguli  $H$  dicitur, id quoque de sinu lato-  
ris  $QB$  dici cognoscitur. Item:

Ut sin. compl. Ad Radium :

lateris angulo

recto adjacentis

Vel per 46. c. 4.

Ut Radius Ad secantem

istius lateris :

Sic sinus com- Ad sin. com-  
plementi hy- plementi late-  
potenusa ris reliqui.

Ut Radius Ad sin. comp. late- Sic sinus com- Ad sinum com-  
ris circa angulum plementi late plementi hypo-  
rectum unius : ris alterius tenusa.

Vel per ult. c. 4.

Ut Radius Ad secant. la- Sic secans la- Ad secantem  
teris alterutr. teris alterius hypotenusa.

Denique per ult. & penult. c. 4.

Ut Radius Ad sinum com- Sic secans hy- Ad secant. la-  
plem. vel sec. lat. unius. potenusa teris alterius

In priori hemisphærio assumatur aliud  $\Delta$  lum C Q K  
ad Q rectangulum, per 18 c. 2. propterea quod Circulus  
B Q C D transit per Circuli Q K H polum D. Latera  
rectum includentia sunt C Q & Q K : complementa eo-  
rum Q B & K H : hypotenusa C K, cujus complemen-  
tum K I. Per superius itaque demonstrata est ut P Q si-  
nus complementi lateris Q C ad Q A radium : sic N k  
sinus complementi hypotenusa C k ad k L sinum com-  
plementi lateris Q K. Et ut A Q radius ad Q P sinum  
complementi lateris C Q : sic L k sinus complementi la-  
teris Q k ad k N sinum cōplementi hypotenusa C k. Per-  
mutatio sinuum in secantes propriè talis esse debet ut juxta  
p. ult. c. 4. pro sinu complementi lateris circa angulum re-  
ctum prioris collocetur Secans lateris posterioris, & contrà :  
sed per commutationē proportionum alternam perinde est,  
utrius lateris secantem secundo vel tertio loco ponas, ut ex  
Arithmetica vulgari notum est

L 4

Item

Item accidentariè:

**Vt Radius Ad sinum com.** Ita sinus acuti **Ad sinum com-**  
**plementi late-** huic lateri ad-**plementi alte-**  
**ris ang. recto jacentis** **rius acuti.**  
**adjacentis;**

Vel per penult. c.4.

**Vt Radius Ad secant. la-** Ita sec. cõple **Ad secantem**  
**teris istius:** **menti anguli acuti reliqui.**  
**istius acuti**

**Et Vt sin com. Ad Radium:**  
**plementi late-**  
**ris istius**

Vel per 45. c.4.

**Vt Radius Ad secantem**  
**istius lateris:**

Sic sinus com. **Ad sinum**  
**plementi acuti ang. reliqui.**  
**lateri oppositi.**

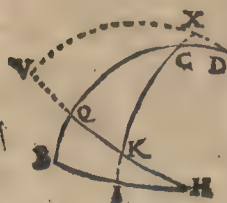
**Et Vt Sinus u. Ad Radium:**  
**nus acuti**

Vel per 45. c.4.

**Vt Radius Ad sec. compl.**  
**istius acuti.**

Sic sin. com. **Ad sinum com-**  
**plementi al plementi late-**  
**terius acuti. ris oppositi.**

Accidentariè hæc sequi dico, quatenus scilicet anguli  
 Δlorum datorum in latera & hæc in angulos permutantur  
 juxta p. 24. c. 3. Resumpto ex præcedenti figura Triangulo  
 H I k, cum suis continuationibus B Q C k continuentur ul-



terius k Q in V, k C in X, Q C  
 in D, ut arcus k V, k X, Q D  
 sint quadrantes, adeoq; sint equa-  
 les arcus H k & Q V, B Q &  
 C D, I K & C X; connectantur  
 etiā in termini continuationum a-  
 lio quadrante V X D. Erut ergo

Alum  $CXD$  ad  $X$  rectangulum, propterea quod anguli  $X$  mensura est quadrans  $VQK$ . Vltimus hypotenusa  $C$  est tanta quantum in Triangulo  $kHI$  angulus ad  $H$ : huius enim mensura est  $BQ$  equalis illi  $CD$ . Sic angulus acutus ad  $D$ , cuius mensura  $VQ$ , sit equalis lateri  $kH$  in prioris Triangulo. Angulus acutus ad  $C$ , cuius mensura  $BI$ , est idem quod complementum lateris  $HI$ : & vice versa angulus acutus ad  $k$ , cuius mensura  $VX$ , est complementum lateris  $XD$ . Quare per specialem huius prop. proportionem primam Ut Radius ad Sinum hypotenuse  $DC$  hoc est  $QB$  mensura anguli  $H$ , sic sinus acuti  $C$ , cuius mensura  $BI$  complementum scilicet lateris  $IH$ , ad sinum lateris  $XD$ , cuius complementum  $XV$  mensurat angulum acutum  $k$ : & contra, item per proportionem secundam, Ut sinus hypotenuse  $CD$ , id est  $QB$  mensurantis angulum  $H$  est ad Radium, sic sinus lateris  $DX$ , cuius complementum  $XV$  mensurat angulum  $k$ , est ad sinum anguli  $C$ , cuius mensura  $BI$  complementum est lateris  $IH$ ; & contra.

X. 2. In iisdem continuatione ortis Triangulis, Sinus laterum communi acuto adjacentium, Tangentibus laterum eidem oppositorum directe sunt proportionales.

In figura prop. 8 huc repetita Triangulis  $HIk$  &  $H Bk$  resumitur est ut  $AB$  sinus lateris  $HB$  (h.e. sinus quadrantis siue Radius) ad  $BM$  tangentem lateris  $BQ$ , sic  $LI$  sinus lateris  $HI$ , ad  $LO$  tangentem lateris  $Ik$ . Triangula namque plana  $ABM$  &  $LIO$  sunt hic equiangula iisdem de causis, quibus ibi fuerunt  $APQ$  &  $N Lk$ , neque res demonstratione nova indiget. Valent hinc ergo proportionem:



Vt  $AB$  ad  $BM$ , Sic  $LI$  ad  $IO$ . Et

Vt  $LI$  ad  $IO$ , Sic  $AB$  ad  $BM$ . al-

Vt  $OI$  ad  $IL$ , Sic  $MB$  ad  $BA$ . ter-

Vt  $MB$  ad  $BA$ , Sic  $OI$  ad  $IL$ . nè.

Proportiones secantium  $AM$  &  $LO$  non sunt hujus loci.

**XI.** Hinc derivatio proportionum specialis in Triangulo cum duobus acutis rectangulo quocunque:

Vt Radius Ad tangentem Ita sinus lateris Ad tangentem alterut. acuti: r̄is adjacentis lat. oppositi

Vt Tangens Ad Radium:

acuti

Vel per 42. c. 4.

Vt Radius Ad T. compl.

istius acuti:

Ita T. lateris Ad sinum lat. acuto oppositi adjacentis

Vt sinus lateris Ad Radium:

acuto adjac.

Vel per 43. c. 4.

Vt Radius Ad sec. compl.

lateris istius:

Ita Tang. lat. Ad tang. ipsius lateris acuto oppositi acuti.

Quod supra ad tres priores proportionum pr. 9. monui de mensura anguli  $H$ , idem hic repeti volo: sic ut quicquid hic de tangente anguli  $H$  dicitur, id quoque de tangente arcus  $BQ$  intelligatur. Item:

Vt sinus com. Ad Radium:

plem. acuti

Vel per 46. c. 4.

Vt Radius Ad secantem

acuti:

Sic tang. com. Ad T. compl.

plem. hy. lateris acuto potensu adjacentis.

**Ut Radius** Ad sinum com- Sic tang. com- Ad tang. com-  
 plementi ang. plementi late. plementi hy-  
 acuti: ris adjacentis potenusæ.

Vel per 43 & penult. c.4.

**Ut Radius** Ad secantem Sic tangens la- Ad tangentem  
 acuti teris adjac. hypotenusæ.

Et per easdem:

**Ut Secans** Ad Radium:

acuti

**Ut Radius** Ad sinum com-  
 plem. acuti.

Sic Tang. hy. Ad Tang. lat.  
 potenusæ acuto adjac.

**Ut T. com.** Ad Radium:

plem. lateris.

Vel per p. 42. c. 4.

**Ut Radius** Ad Tang. la-  
 teris:

Sic Tan. com- Ad sin. com-  
 plementi hy- plementi ang.  
 potenusæ lateri adjac.

Huc pertinet repetitio eorum, quæ ad secundam pro-  
 portionum classem prop 9. diximus. Nam quæ de sinibus illic  
 demonstrata sunt, eadem hic de tangentibus demonstrare  
 possunt.

Et accidentariè:

**Ut sinus compl.** Ad Radium:

Hypotenusæ

Vel per p. 46. c. 4.

**Ut Radius** Ad secantem  
 hypotenusæ:

Sic tangens Ad tang. acuti  
 alterutrius reliqui.  
 acuti

**Ut Tang. al.** Ad Radium:

terutr. acuti

vel per p. 42. c. 4.

**Ut Radius** Ad Tangen.  
 complementi  
 istius acuti:

Sic Tan. com- Ad sin. com-  
 plementi al- plementi hy-  
 terius acuti potenusæ.

Huc pertinet permutatio angularum in latera & contra: de qua ait Clavius in proportionum tertiam p. 9. Quæ ibi demonstrata sunt de sinibus, ea hic applicantur tangentibus, ut cuiusvis, qui superiora sciâliet & exacte pervadit, obvia est.

Et ita calculum reſtangularum abſolvimus. Reſtat ut eum uno atque altero exemplo illuſtrems. Affumamus autem exempla tum ob utilitatem tum ob jucunditatem è ſphæra mundi.

Sit igitur in repetito Hemisphærio prop. 8. Circulus BQCDE Colurus Solſtitiiorum: BIHTE Æquator, cujus polus C: QkHSF Ecliptica, cujus polus D: CkIRG circulus declinationum aliquis: Q ſit principium  $\odot$ , H  $\oplus$ , k  $\odot$ . Sit autem primò querenda declinatio prin.  $\odot$   $\odot$  hoc eſt arcus kI. Dantur in Triangulo HI k præter angulum rectum ad I angulus ad H inclinationis Eclipticæ ſive maxima declinationis  $\odot$ , juxta Tyconem 23 gr. 31' min. unâ cum hypotenufa H k 60 gr. diſtancia nempe principii  $\odot$  ab interſeſtione  $\oplus$  H. Dico per proportionem p. 9.

Ad Radius Ad ſinum QP ar-Sic ſinus L k Ad ſinum kN  
AQ  
cus BQ ſive anguli hypotenufa H declinationis  
H inclinationis E- k 60 gr. quaſive kI  
ecliptica 23 gr.  
31' min.

100000 — 39915 — 86603 — 34567

Declinatio igitur principii  $\odot$  eſt 20 gr. 13. min. 22. ſecund.

Eadem declinatio etiam ſimplici proſtaphæreſi reperitur per prop. 13. & 15. Ex datis complementis hypotenufe & arcu QC cum comprehenſo angulo recto: Vide  
exem-

Exemplum reg. 2. Coronidis post explicatum calculum  
 $\Delta$ lorum spher.

Deinde sit querenda etiam Ascensio Recta principii  $\Omega$ :  
 que innotescit ex ejus complemento ad semicirculum,  
 hoc est ex arcu  $I H$  intercepto inter declinationem ejus  $\Theta$   
 principium  $\Omega H$ .

Hunc arcum in  $\Delta$ lo  $H I k$  pluribus modis investigare  
 possumus. Saltem tres ostendemus.

I. Ex dato angulo  $H \Theta$  latere  $I k$ :

Vt  $M B$  tangens anguli  $H$  23 gr. 31 m. Ad Rad.  $B A$

Vel per p. 42. c. 4.

Vt Radius Ad 229710 Tangens. complem. istius  
 anguli:

Sic  $O I$  36838 tangens lateris  $I k$  20 gr. 13 min.  
 22 secund. Ad  $I L$  84620: sinum lateris quasi  $I H$  57  
 gr 48 m. 6. secund.

II. Ex dato latere  $I k$  & hypotenusa  $H k$ :

Vt Radius Ad 93835 sinum complementi lateris  $I k$ :

Sic 200000 secans hypotenusa Ad 187670 secan-  
 tem lateris  $I H$  57 gr. 48 m. 6 sec.

III. Ex hypotenusa  $\Theta$  angulo  $H$ :

Vt Radius Ad 91688 sinum complementi anguli  $H$ :

Sic 173205 Tang. hypotenusa Ad 158808 Tang.  
 lateris 57 gr 48 m. 6 sec.

Hujus ergo lateris complementum ad semicirculum  
 122 gr. 13 min. 54 sec. est Ascensio recta  $\Omega$  quasi.

XII. 3. In Triangulo spherico quocunque  
 sinus laterum finibus oppositorum angulorum  
 directe sunt proportionales.

Id ae Triangulis quidem rectangulis prop. 8. s. is su-  
 perius demonstratum est. Constat enim in Triangulo  $H I k$   
 esse





Operatione peracta provenit 99617 sinus anguli BC  
 A 84 gr. 59 min. cuius complementum ad duos rectos est  
 quæsitus ad C ob usus 95 gr. 1 min.

Noletur hic elegans inventum, quo divisio per sinum  
 primi loci peragenda in multiplicationem convertitur, Ni-  
 mirum demissione perpendiculari ex angulo ignoto in latus  
 angulo noto adjacens, si opus sit, continuatum: quo ipso sunt  
 duo  $\Delta$ la rectangula, quorum latus commune est ipsum per-  
 pendiculum: unde facilius Quæsitum innotescit. Exempli  
 gratia, in nostro  $\Delta$ lo si perpendicularum demittatur AB in  
 latus k C continuatum, erit per p.prac. primum in  $\Delta$ lo A  
 B k rectangulo ad B Vt 100000 ad 97113 sinus ang. k,  
 sic 94702 sinus hypotenuse A k ad 91969 sinus lateris  
 AB. Deinde in Triangulo ABC Vt 100000 ad 91969  
 sinus lateris AB modò invenium: sic 108318 secans com-  
 plementi lateris AC dati, ad 99619 sinus anguli BCA  
 parùm ab inventione priori differente: & iste excessus ori-  
 tur è primo quotiente unitate aucto ob causam ad prop. 4. c.  
 antec. dictam.

Igitur in exemplis hujus p. 12. hoc compendio usus  
 primùm terminis duobus posterioribus inter se pro more  
 multiplicatis à productò rescinde characteres 5 dextros,  
 residuos sinistros multiplica per secantem complementi ter-  
 mini primi: productum denud 5 characteribus dextris di-  
 minutum exhibet Sinum lateris aut anguli quæsit.

XIII. 4. In Triangulo spherico quocunque, si  
 duo latera sigillatim quadrante minora primum  
 ipsa inter sese deinde latus minus cum comple-  
 mento majoris componas, & sinui arcus compositi  
 posterioris sinum complementi arcus cōpositi prioris  
 subtra-

subtrahas aut sinum excessus supra quadrantiem addas: Tunc ut Radius est ad semissem hujus residui vel summæ sinuum, ita sinus versus anguli duobus illis lateribus comprehensi, est ad rectam, quæ de sinu compositi arcus posterioris subtracta relinquit sinum complementi tertii lateris, aut ab ea subtractus ille sinus compositi arcus posterioris relinquit sinum excessus tertii lateris. Et contrà: Ut ista residui vel summæ sinuum semissem est ad Radium, sic recta est sinu arcus compositi posterioris, vel per subtractionem sinus complementi tertii lateris residua, vel per additionem excessus tertii lateris aggregata, est ad sinum versus anguli à reliquis duobus lateribus comprehensi.

Est quartum axioma sphericorum eiusdem: quod generaliter ab ipso positum in plures regulas distrabere nolui. Alioquin varios continet casus. Aut enim ex datis duobus lateribus cum angulo ab illis comprehenso manifestat latus tertium: aut ex datis omnibus lateribus exquirat angulum aliquem à duobus lateribus singulatim quadrante minoribus comprehensum. Rursum utrobique, ista latera sunt conjunctim quadranti vel equalia vel minora vel majora, et comprehensus angulus potest esse vel rectus vel acutus vel obtusus, atque ita latus tertium vel quadrans vel eo minus aut majus. Ideoque hujus axiomatis usus in Astronomia latissimus est, nec strictus in Geographica distantie locorum supputatione. Appellatur ultatè Problema Prosthæphæreticum, propterea, quod quæ per usitatas Trigonometriæ regulas apud Regiom. Finckium, Landspergium non nisi reductione obli-

quangulorum

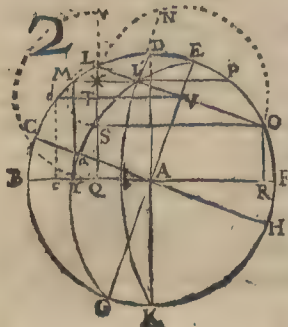
quangulorum ad rectangula, multiplici proportionum calculo, laboriose inveniuntur, ea per hoc problema sinuum & arcuum vel additione vel subtractione debito modo facta, simplici & una proportionem absolvuntur. Insistam in huius axiomatis declaratione ac demonstratione vestigiis Pitisci, ut ait Adrianus Metius in Astronomia sua Pitiscum in his nonnihil hallucinatum scribat, non autem demonstret, de quo infra. Sed Pitisci illa tria (quibus necessarium nobis videbatur adungere quartum) demonstrationis Analemmata ista in una opera ad sphaeram mundi applicabimus.

Est igitur in sequentibus 4 figuris omnibus Circulus B C D E &c. Meridianus aut Colurus Solstitionum: B A F diameter horizonis: E A G axis mundi, polo E arctico, G antarctico: C H diameter aequatoris, D k Solet etiam a diameter verticalis D I b k: E I G Circulus sumi B A F pro declinationum. Quibus praestructis  $\Delta$ lum diameter aequatoris, polo eius propositum sit D E I, cuius semper duo latera nota sunt, unum nempe D E complementum elevationis poli E F, aequale elevationi aequatoris B C, alterum E I complementum declinationis I a: angulus datus aut questus est semper ad E, lateri tertio D I oppositus: revolutionis puncti I diurna diameter est L I O, sic ut punctum I meridiana transiens coincidat cum puncto L, & ita perspicuum est latus E I aequale esse arcui E D L: non secus ac latus D I aequale est arcui D L M, puncti namq; I altitudo I b eadem est quae M C B. Quod si etiam semiperipheriam revolutionis diurnae puncti I ducere libeat, sit ea L N O, sic

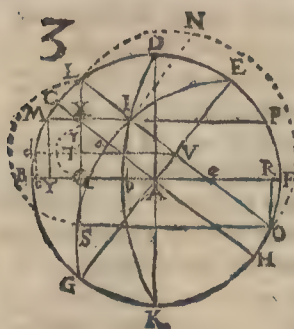
tamen ut copitetur punctum  $N$  cum puncto  $I$  in sphaera idem esse. Porro in hac semiperiphæria est arcus  $LN$  mensura ang.  $E$ : est enim hic parallelus non sit Circulus in sphaera maximus, tamen cum habeat eundem cum parallelo maximo sive equatore polum & æquæ suis  $360$  gr. constet, erit eadem in utroque ratio tum similium arcuum per p. 7 c. 1. tum Sinuum tam rectorum quam versorum per p. 8 c. 4. Atque ita etiam recta  $IN$  est Sinus rectus arcus  $LN$  hoc est anguli  $E$ , &  $IL$  est Sinus versus ejusdem anguli vel arcus.



Itam lateri majori  $EI$  hoc est (per superius declarata)  $EL$  sit æqualis arcus  $EO$ , lateri q̃ minori  $DI$ , hoc est  $DM$ , æqualis arcus  $DP$ .



Componantur nunc primum inter se duo latera angulum  $E$  comprehendentia,  $DE$  &  $EI$  hoc est  $EO$ , hūq̃ arcus ex his compositus, qui compositus prior in axioma vocatur, in primo quidem analemmate quadranti  $DF$  æqualis, in secundo minor, in tertio major: Sinus complementi in secundo est  $OR$ , Sinus excessus in tertio itidem  $O$   $R$ . Componatur deinde etiam



iam latus minus  $ED$ , hoc  
est (per superius declarata)  
 $BC$  cū lateris majoris com-  
plemento  $La$ , hoc est,  $LC$ ,  
sitq; arcus ex his compositus  
posterior  $BL$ , ejusq; Sinus  
rectus  $LQ$ : Cui in secunda  
figura Sinus complementi  $O$   
 $R$ , h. e.  $QS$  subtractus, in  
tertia & quarta Sinus ex-  
cessus  $OR$  h. e.  $QS$  additus

manifestat rectam  $LS$ ,  
quæ cum rectis  $LO$  &  $SO$   
 $\Delta$ lum constituit planum  
ad  $S$  rectangulum, cujus  
crura  $SL$  &  $LO$  si bise-  
centur rectâ  $TV$  paral-  
lelâ basi  $SO$ ;  $\Delta$ lum  
efficitur  $TLV$  per p. 12.  
c. 3. priori  $SLO$  simile  
similiorq; positum: in  
quo iterum in prioribus



3 figuris recta  $IX$  parallela basi  $VT$  secat crura  $LT$  &  $LV$   
proportionaliter per p. 10. c. 3. in quarta verò figurâ re-  
cta illa  $XI$  secat proportionaliter crura  $LS$  &  $LO$   $\Delta$ li  
 $LSO$ . Vt sit in omnibus velut  $VL$  ad  $LT$ , sic  $IL$  ad  $LX$ ,  
hec est, ut nunc proportionem hanc ad propositum nostrum  
accommodemus, Vt  $VL$  Radius (eandem habens rationem  
ad suos in minori Circulo sinus, quam radius  $CA$  ad suos, ut  
paulò antè ostensum est) ut  $VL$  inquam ad  $LT$  semissem re-  
cta  $LS$  ex arcuum compositorum eorumque complemen-



eorum aut excessuum sinibus oritur: Sic  $IL$  sinus versus  $AE$  anguli  $E$  est ad  $LX$ , quâ in tribus prioribus analenmati-  
bus subtractâ de  $LQ$  Sinu posterioris compositi arcus  $BCL$ ,  
aut de qua in quarto analenm. subtracto ipso sinu  $LQ$ ,  
relinquitur  $XQ$  hoc est, per p. 14. c. 2  $MT$  sinus arcus  
 $BM$ , qui in tribus anal. prioribus est complementum in quar-  
to verd excessus lateris tertii  $MD$  sive  $DI$ . Et contrâ, Vt  
 $TL$  se nris rectæ  $LS$  ad radium  $LV$ , sic recta  $XL$  post  
Sinum complementi tertii lateris à Sinu posterioris arcus  
compositi subtractum residua, vel in 4. figura post Sinum  
excessus additum constata, est ad  $LI$  sinum versum anguli  $E$ .

Hæc est itaque demonstratio axiomatis Pitsci, satis  
aperta: quem nescio quo jure dicat Adrianus Metius non-  
nihil hallucinatum. Ipse quidem Pitsci errorem non osten-  
dit, sed methodum duntaxat & exempla singulorum ca-  
sum præscribit. Ac methodus quidem non satis attendendi  
posset videri à methodo Pitsci aliena: verum tota res eo-  
dem redit, ut paulò post exemplis Metianis ad Pitsci me-  
thodum accommodatis ostendemus. Non hæc loquor, Me-  
tium virum excellentem deq; studiis Astronomicis benè me-  
ritum sursum illaturus, sed axioma Pitsci à suspitione vin-  
dicaturus.

#### XIV. Hinc consecutaria proportionum spe- cialia.

1. Si data duo latera conjunctim sint qua-  
drante minora; sinus complementi subtra-  
hitur sinui arcus compositi posterioris: sin  
fuerint quadrante majora; sinus excessus addi-  
tur sinui dicto: semissis summæ vel residui est  
secundus terminus proportionalis: sin deniq;  
fuerint

fuerint quadranti æqualia; semisinus compo-  
 fiti arcus posterioris est secundus terminus pro-  
 portionalis. Anguli dati sinus versus est ubiq;  
 proportionalis tertius.

*Exempla Adriani Metii juxta nostram methodum:*

1. *vbi data latera conjunctim sunt quadrante minora.*

Latus majus 58 57. " Eius compl 31 3 "  
 minus 23 31 30 ——— 23 31 30

Comp. prius 82 28 30 Comp. post. 54 34 30 Sin. 81487

Complement. 7 31 30 ——— Sin. 13095

Angulus datus 108 45 Resid. 68392

Cujus i. versus 132144 per p 8. c. 5. Semissis 34196

*Igitur in schemate nostro secundo*

U: VL 100000 Ad LT 34196: Sic IL 132144 Ad LX 45188

Quæ ablata à sinu L Q ——— 81487

Relinquit arcus 21 17 2 sinum XQ vel MY 36299

Cujus compl. 68 42 58 est latus tertium quærit.

Omnes hos arcus, Sinus, &c. habet & Metius præter  
 compositum prius: pro cujus complemento jubet ille (quod  
 idem est) inquirere differentiam lateris minoris & comple-  
 menti majoris, ita ut hi duo arcus primum inter se ad-  
 dan. ur, deinde subtrahantur, & Sinus differentia subtra-  
 hatur à sinu summa &c.

II. *Vbi data latera conjunctim sunt quadr. majora.*

Latus majus 84 29 " Eius compl. 5 31 "  
 minus 23 31 30 ——— 23 31 30

Comp. prius 108 0 30 Comp post. 29 2 30 Sin. 48544

Excessus 18 0 30 ——— Sin 30915

Angulus datus 154 18 Summa 79459

Cujus sin. vers. 190108 per p. 8. c. 5. Semissis 39729

Igitur in schemate nostro quarto

Ut VL Rad. Ad LT 39729: Sic IL 190108 Ad LX 75528

A qua sublatus sinus L Q  $\frac{18544}{100000}$

Relinq. excessus MB 15 39 9 sinum QX vel MY 26984

Qui excessus quadranti additus componit l. tertium  
quæsitum 105 gr. 39. m. 9. sec.

Metius omnes iterum hos terminos habet præter com-  
positum prius: pro cuius excessu jubet inquirere (quod  
idem est) lateris minoris & compl. majoris differentiam.

¶ I I. Vbi data latera conjunctim sunt quadr. equalia.

Tum summa laterum non habet complementum vel  
excessum, ideoque nihil etiam sinui posterioris composui  
potest addi vel subtrahi, sed ipse statim sinus dimidiatur.

Latus majus	56	10	Compl.	33	50
minus	33	50		33	50

Compos. prius 90 0 Comp. post. 67 40 — sinus 92499

Angulus dat. 45 6

Semissis 46249

Cujus s. versus 29413. per p. 8. c. 5.

Igitur in schemate nostro primo:

Ut VL Rad. Ad LT 46249: sic IL 29413 Ad LX 13603

Quæ ablata à sinu L Q  $\frac{92499}{100000}$

Relinquit arcus 52 5 17 sinum XQ vel MY 78896

Cujus compl. 37 54 43 est latus tertium quæsit.

Omnes hos terminos etiam habet Metius, præter com-  
positum prius: Jubet enim Crus minus jungere comple-  
mento majoris, producit sinum dimidiare, &c.

N. Si data latera conjunctim sint quadranti equalia  
vel minora, semper quidem latus tertium est quadrantis  
minus per p. 24. c. 1. Sed non si sint majora, latus etiam

tertium

tertium est quadrante majus, sed interdum etiam si angulus datus obtusus est, adhuc illud est quadr. minus.

XV. 2. Si datus angulus sit rectus, latus tertium invenitur simplici prosthaphæresi: semissis enim summæ ex aliquo subtrahendis aut residui ex aliquo addendis sinibus compositorum arcuum est sinus complementi tertii lateris quæriti.

Hoc est illud compendium prosthaphæreticum preciosissimu. Si angulus datus sit rectus, punctum  $\Gamma$  semper in sphaera superficie coincidit cum  $V$ , tumq; sinus complementi tertii lateris evadit  $TQ$ , quasi d c in tribus schematibus ad sinistram (in quarto schemate ita commodè d c delineari nequit.) Sinus autem versus anguli dati est Radius, quasi recta  $VL$ , cui respondet proportionalis  $LT$ , hoc est,  $TS$ , semissis rectæ  $LS$ , qua, ut è superioribus notum est, in primo schemate eadem est cum sinu  $LQ$  posterioris compositi, in secundo est residuum ejusdem Sinus, detracto complementi prioris compositi sinu  $OR$  vel  $SQ$ , in reliquis duobus composita est è sinu  $LQ$  & excessus sinu  $QS$ . Igitur in primo schemate ubi data latera quadranti sunt equalia,  $TQ$ , Sinus complementi tertii lateris, idem cum  $TS$  semisse sinus  $LS$  vel  $LQ$  statim habetur dimidiato ipso sinu  $LQ$ : in secundo, ubi sinus  $OR$  aut  $SQ$  aliquo subtrahitur à sinu  $LQ$  nunc additus ad  $ST$  componit sinum quæsitum  $TQ$ : in tertio & quarto, ubi sinus  $OR$  aut  $SQ$  aliquo addendus esset sinus  $LQ$ , nunc subtractus, recta  $ST$  relinquit sinum quæsitum  $TQ$ .

E: quia tunc adhuc recta TS ignota est, igitur (sic res eodem redit) in secundo schemate recta SQ, hoc est, in superiori parte Lr, additur Sinui LQ, summa r Q dimidium r T vel TQ est Sinus quæsitus: in tertio & quarto illa SQ, hoc est, in superiori parte Lr, adimitur Sinui LQ, residuum r Q semipis r T vel TQ est Sinus quæsitus.

Nunc exemplum addamus:

Latus majus	<sup>0</sup> 36	<sup>1</sup> 43	Complem.	<sup>0</sup> 53	<sup>1</sup> 17
minus	34	30		34	30
Compos. prius	71	13	Comp. post.	87	47
Complem.	18	47			
					sinus 99925
					sinus 32199

Angulus datus est rectus.

Summa 132124

Semipis est sinus quæsitus 66062

arcus scil. 41 gr. 20 min. 24 secund. cujus complementum 48 gr. 39 min 36 secun. est latus quæsitum. Aliud exemplum æstheticum vide sub finem hujus Trigonometria, regula prosthaph. secunda.

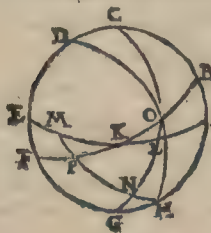
XVI. 3. Si angulo dato obliquo quartus terminus proportionalis æquetur sinui posterioris compositi; latus tertium quæsitum est quadrans.

Si forte contingeret, ut (in analem. tertio) punctum I foret in e, quartus proportionalis evaderet ipsa LQ Sinus posterioris compositi, quæ si à seipsa subtrahatur, nihil relinquit pro Sinu complementi tertii lateris.

XVII. 4. In Triangulo obliquangulo si laterum angulum datum quæsitumve comprehendunt alterutrum sit quadrans, altero similiter ad quadrantē continuato cumq; priori per  
mensuram



mensuram anguli dati quæsitivæ connexo, Triangulum adsciscitur rectangulum trium notorum terminorum, quibus facilius obliquanguli Trianguli quæsitæ perveſtigantur.



Ut in præſenti hemiſphærio ſi dati  $\Delta$ li C D O latus D O ſit quadrans, continuetur etiam latus D C ad B, ut D B etiam fiat quadrans, & ſubtendatur B O meſura anguli D. Quo iſſo  $\Delta$ lum ſit B C O ad B rectangulum ( $\Delta$ lum enim B D O eſt æquicrarum cruribus ſigillatim quadrantem æquantibus) in quo dantur præter ang.

rectum B latus C B complementum lateris dati C D & latus B O meſura anguli D, ſi iſte angulus datus ſit, aut ſi iſ quæſatur, datum erit latus C O. Unde quæſitum  $\Delta$ li C D O per calculum rectangulorum innoteſcit.

XVIII. 5. Si dato latere tertio, quæſatur angulus ipſi oppoſitus, & tertius proportionalis terminus æquetur ſemiſſi reſidui vel ſummæ ſiquum ſupradictæ; angulus quæſitus eſt rectus: ſin tertius iſte proportionalis major aut minor ſit, angulus etiam ſit oppoſitus pari modo obtuſus aut acutus eſt.

Demus nunc etiam exemplum axiomatis inverſi, ubi nempe datis tribus lateribus quæſatur angulus duobus lateribus ſigillatim quadrante minoribus comprehenſus. Methodus in prioribus duobus proportionum terminis acquirendis eadem eſt quæ antea: Nempe latera angulum quæſitum comprehendentia primum inter ſeſe deinde latus minus

Cum complemento majoris componuntur, & sinui posterioris arcus compositi subtrahitur sinus complementi prioris compositi vel additur sinus excessus prioris compositi; summa vel residui semissis est terminorum proportionalium unus, & radius est alter. Tertius autem proportionalis accedit, si sinui posterioris compositi addas sinum excessus tertii lateris supra quadrantem, vel de trahas sinum complementi tertii lateris ad quadrantem: summa vel residuum hoc, est proportionalis tertius. Qui si idem est cum primo, nempe dimidia summa vel residuo Sinuum supradictorum; indicium est, etiam quartum proportionalem fore Sinum Totum: qui sive ut Sinus rectus sive ut versus assumatur, Sinus est anguli recti. Quod si primus cum tertio non convenerit, operatione instituta provenit Sinus versus anguli quaesiti.

Sit investiganda distantia ☉ à meridiano per quam illam hora diei, quando Sol occupat 20 gr. 8, & ejus altitudo supra horizontem tempore pomeridiana est 42 gr. cum triente. In analemmate supra posito tertio, altitudo ☉ est 16 (hoc est MB): complementum ejus sive distantia à vertice ID, hoc est MD, 47 gr. 40 m. est unum latus Δli DIE propositi: declinatio loci ☉ est a I hoc est CL 17 gr. 48<sup>1</sup>/<sub>2</sub> m. cujus complementum IE, hoc est LDE, 72 gr. 21<sup>1</sup>/<sub>2</sub> min. est secundum latus Δli IDE: tertium est DE complementum elevationis poli, h. e. elevatio Aequatoris BC, quae sit exempli gratia 35 gr. 36 min. Distantiam ☉ à meridiano definit non tantum aequatoris arcus, cujus Sinus versus a C, sed etiam per p. 7. c. 1. & p. 8. c. 4. paralleli per ☉ transeuntis arcus, cujus Sinus versus I L, Et hic est Sinus versus anguli E quarendi. Inquisitio talis est:

EO, vel

E O vel EL 72 21 45 Eius cōpl, LC 174815  
 DE vel BC 536 0 ——— BC 3536 0

DE FO 1075745 BCL 532415 sin 1 Q 80286  
 Excess. FO 175745 ——— sin OR vel Q 530839

LQS III 125  
 Latus tertium DI vel DM 4740 Semissis LT 55562  
 Complem, MB 4220 sin, MY vel XQ 67344  
 sinus LQ 80286  
 Dist. LX 12942

Vt TL 55562 ad LV 100000 :  
 vel per p. 45. c. 4. (TL enim nihil aliud quam sinus est.)  
 Vt Radius ad 179933 secantem complementi :

Sic XL 12942 ad LI 23287 Sin. vers. anguli E 39  
 gr. 54 min. 13 sec. quem mensurat & arcus equatoris &  
 ejus paralleli, ut suprà diximus. Arcus hic distantia ☉ à  
 meridiano invenis resp. horis à mer. numeratis 2.39 m.

XIX. 6. Si datum latus tertium sit quadrans,  
 pro tertio termino proportionali habetur sinus  
 posterioris arcus compositi.

Nullum enim hic esset lateris tertii complementum aut  
 excessus : idcirco etiam nihil isti sinui subtraheretur aut ad-  
 deretur, sed Sinus maneret immutatus.

XX. 7. Denique etiam accidentariè, mutatis  
 lateribus in angulos & contrà, per has propor-  
 tiones in Triangulo sphærico quocūq; datis tri-  
 bus angulis latus aliquod angulis duobus com-  
 prehensum, aut datis duobus angulis cum inter-  
 jecto latere angulus tertius investigari potest.

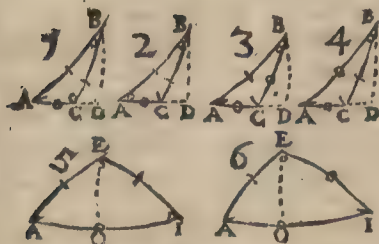
In primo casu loco trium angulorum cogitentur tria la-  
 tera, tanta singula quantitatis, quanta dati sunt anguli, ex-  
 cepto angulo maximo, ejus complementū ad semicirculum

pro latere tertio assignatum est per p. 24. c. 3. Atque ita ex datis 2 na, in tri $\Delta$ liribus lateribus exploratur angulus aut unus aut omnes: horum angularum mensura erunt latera propositi  $\Delta$ li quesita, sed ita, ut vicissim anguli maximi inventi complementum ad semicirculum pro respondente latere sumatur. In secundo casu consideretur  $\Delta$ lum duorum datorum laterum cum angulo ab illis comprehensio, sic ut etiam pro latere & angulo maximo complementa eorum ad semicirculum assumantur.

**XXI.** Sic fuit supputatio Quæstionum in Triangulo spherico directæ: Indirectæ per præcedentem perpendiculari demissionem regula universalis hæc est: Si perpendicularis angulum notum ejusve ad duos rectos complementum subcendens demittatur in latus ex angulo obtuso, cadit intra Triangulum: Sin ex acuto, cadit extra in latus continuatum. Utroque modo fitit duo Triangula rectangula trium notorum terminorum, quibus attributis propositi Trianguli quesita innotescunt.

Huc perunt omnia ea Triangula, quorum data non congruunt ad Regulas proportionum hæcenus traditas. Requiritur autem hic unus ad minimum angulus notus, e cujus aut eius ad duos rectos complementi opposito demittatur perpendicularum. Omnes hujus propositionis varietates ad oculum exhibemus hisce 6  $\Delta$ lis: in quibus juniores sciant terminos datos notari (ut moris est) trajectis virgulis quæstios autem circellis sive cyfris.

In prioribus quatuor perpendicularis BD demissa ab angulo acuto B cadit extra  $\Delta$ lum in latus AC continua-



tum ad D, & subiendū in primo Triangulo angulum notum A, in secundo anguli obtusi notū C complementū hoc est, angulum

Ca utum in  $\Delta^o$  rectangulo CBD, in tertio & quarto subiendū angulum A & obtusi mul C complementum. In posterioribus duobus  $\Delta^is$  AEO & EOI perpendicularis EO demissa ex angulo obtuso cadit intra  $\Delta^um$ , & subiendū in  $\Delta^o$  quinto angulum A notum, in sexto angulos notos duos A & I. Ubivis hoc perpendiculum facit duo  $\Delta^a$  rectangula, in prioribus 4  $\Delta^is$  sunt ABD & CBD, in posterioribus AEO & EOI: uorum rectangulorum particulari calculo, quasitaque per precedentes regulas inveniri nequeunt (ind etiam qua per eas inveniri possunt: sed quis ambages praeferat compendii?) innotescunt.

Ex. gr. circa primum  $\Delta^um$  assumto rectangulo ABD dantur in eo hypotenusa AB cum angulo acuto A, ergo per proportionem superiorum regularum inveniuntur latera reliqua BD & DA, nemq; angulus ABD. Pdsst assumto  $\Delta^o$  rectangulo CBD d. mur in eo hypotenusa CB cum invento pridem latere BD, ergo invenitur latus reliquum CD & angulus acutus uterq;. Tertio angulus modò inventus CBD subtrahitur à prius invento ABD relinquitur angulum ABC  $\Delta^i$  propositi: item anguli BCD modò inventi complementum ad duos rectos est angulus obtusus ACB: denique latus modò inventum CD subtrahitur à prius



prius invento AD relinquit latus AC  $\Delta$ li propositi ABC.  
Et sic in aliis etiam quesita latere non possunt, modo iusta  
fiat perpendiculari demissio.

XXII. Harum itaque proportionum his 5 re-  
gulis contentarum adminiculo totus Triangulorum  
Sphæricorum calculus absolvitur, ut è sequenti dia-  
typosi perspicuum est.

Rectangulum quædam Triangulorum proportionum o-  
mnes suprà enumeratas hîc non reperiemus, sed tantum eas,  
quarum calculum Sinus totus primo loco positus efficit faci-  
liorem: imò cum ad singula data sint etiam plures propor-  
tiones, quæ sinum totum habent primo loco, nos tantum u-  
nicam brevitatæ gratia, singulis datis applicabimus.

## IN TRIANGULO RECTAN- gulo inveniuntur

### HYPOTENUSA

E lateribus reliquis:

Vt Radius Ad secant. lat. Sic secans la. Ad secantem  
alterutrum: teris reliqui hypotenusa.

Expeditus per prosthaphæresin prop. 13. & 15.

E latere alterutro & angulo adjacente:

Vt Radius Ad secantem Sic tang. lateris Ad tang. hypo-  
anguli: tenuse.

E latere alterutro & angulo opposito:

Vt Radius Ad sec. compl. Sic sinus late Ad sinum hy-  
anguli: ris potenuse si ea  
quadrante minor esse debeat; si major, arcus inventi  
complementum ad semicirculu erit hypotenusa.

Ex

Ex angulis acutis:

Vt Radius Ad Tangentem. Ita Tangens Ad Secantem  
anguli unius anguli alterius hypotenusa.

LATVS ANG. RECTO  
adjacens

Ex angulo opposito & hypotenusa:

Vt Radius Ad sinum hy- Sic sinus anguli Ad sinum late-  
potenusa ris quaesiti.

Ex ang. adjacente & hypotenusa:

Vt Radius Ad sinum com- Sic tangens hy- Ad tang. late-  
plem. anguli: potenusa. ris quaesiti.

Ex hypotenusa & latere reliquo:

Vt Radius Ad sinum Sic secans hy- Ad secantem  
complementi potenusa lateris qua-  
lateris dati: sui.

E latere reliquo & angulo huic  
adjacente:

Vt Radius Ad Tang. late- Sic tang. com- Ad sinum late-  
ris dati: plementi an ris quaesiti.  
guli dati

E latere reliquo & angulo huic  
opposito:

Vt Radius Ad sinum la- Sic Tangens Ad tangent.  
teris dati: anguli lateris quaesiti.

Ex angulis obliquis:

Vt Radius Ad sinum al- Sic secans an- Ad secant. la-  
terutrius an- guli reliqui teris quaesiti.  
guli:

ANGV

# TRIGONOMETRIÆ

## ANGVLVS ACVTVS

Ex utroque præter hypotenusam lateres:

*Vt Radius Ad Sec. com- Ita tang. lat. Ad tangentem  
plementi late- reliqui anguli quæsit.  
ris angulo quæsito adjacentis*

Ex hypotenusa & latere opposito:

*Vt Radius Ad Sec. compl. Sic Sinus dati Ad sinum ang.  
hypotenuse: lateris quæsit.*

Ex hypotenusa & lat. adjacente:

*Vt Radius Ad Tang. hy- Sic Tan. com- Ad secantem  
potenuse: plem. lateris ang. quæsit.*

Ex hypotenusa & angulo reliquo:

*Vt Radius Ad secantem Ita Tan. com- Ad tang. ang.  
hypotenuse: plementi an- reliqui.  
guli.*

Ex latere opposito & angulo reliquo:

*Vt Radius Ad Secantem Ita Sec. compl. Ad secant. an-  
Lateris anguli dati guli reliqui.*

Ex latere adjacente & angulo reliquo:

*Vt Radius Ad Secantem Sic Sin. compl. Ad sinum ang.  
lateris dati: anguli dati quæsit.*

## IN TRIANGULO OBLI- quangulo inveniuntur

L A T U S

Ex lateribus reliquis & angulo ab  
illis comprehenso:

Per proportionem prosthaphæreticam propos. 13. ty  
ejus consecuti. E la-

E lateribus reliquis & angulo ab illis  
non comprehenso :

Perpendicularis ab angulo ignoto in ignotum latus de-  
missa facit duo triangul<sup>i</sup> rectangula trium notorum termin.  
quorum particulari resolutione questum latus invenitur.

E duobus angulis & latere interjecto :

Perpendicularis ab alterutro datorum angulorum de-  
missa generat duo  $\Delta$ la rectangula particularim supputan-  
da, ut prudens latus questum.

E duobus angulis & latere uni  
eorum opposito :

Perpendicularis à termino dati lateris in latus angulis  
datis interceptum & si opus sit continuatum demissa, mon-  
strat duo  $\Delta$ la rectangula, quibus resolutis datum latus in-  
venitur.

Quod si alteri datorum angulorum oppositum fuerit  
latus datum, alteri latus questum ; erit

Ut Sinus an- Ad sinum la- Sic Sinus alte- Ad latus qua-  
guli dato late- teris dati : rius ang. dati sinu : per p. 12.  
ri oppositi

Ex omnibus angulis :

Per p. 13. & 20. prostaphere[si] accidentariam, mu-  
tatis lateribus in angulos & contrà.

### ANGULUS

Ex angulis reliquis & interjecto latere :

Per p. 13. & 20. prostaphere[si] accidentariam, mu-  
tatis lateribus in angulos & contrà.

N

Ex

Ex angulis reliquis & latere uni  
earum opposito:

Hac data & antiè habentur in explorando latere:  
proinde perpendicularis demittitur etiam planè ut ibidem.

E duobus lateribus & angulo illis  
comprehensio:

Perpendicularis ab angulo ignoto in latus angulo dato  
adjacens (continuum si opus sit, demissa monstrabit Qua-  
situm per duorum rectang. resolutionem.

E duobus lateribus & angulo uni co-  
rum opposito:

Perpendicularis ab alterutro ignotorum angulorum in  
latus angulo noto adjacens demissa calculo duorum rectan-  
gulorum viam aperit, & manifestat quesitum. Quod si da-  
torum laterum alterum opponatur lateri dato, alterum  
quesito; erit.

Ut Sinus late. Ad Sinum an- Sic Sinus late. Ad sinum angu-  
ris angulo da- guli dati: ris alterius li quesiti.  
to oppositi dati

Ex omnibus lateribus:

Per unam proportionem prosthaphæreticam propos.  
17. & 18.

CORONIDIS LOCO SUBIICIAMUS AU-  
REUM ILLUD PROBLEMA PITISCI:

In Triangulo sphaerico rectangulo datis  
quibuscunque terminis Quæsitum invenire  
sola prosthaphæresi.

Pitiscus



Pitiscus id extendit etiam ad obliquangula, ut extendi quidem firma demonstratione potest, sed non sine ambagibus quibus posthabitis contenti sumus ejus usu in rectangulis tantum.

*Tribus autem regulis absolvitur hoc problema.*

I. Antea omnia si sinus torus non obtineat primum inter data locum, per propp. cap. 4. demonstratas in primum locum retrahatur. *in specie:*

Si primo loco sit Sinus, secundo vel tertio radius, primo loco ponatur radius, & pro sinu inde remoto statuatur secans complementi in locum remoti radii, sive: Sinus primi loci & radius commutent loca, sed ut vicem Sinus obtineat secans complementi. per p. 45. & 46. c. 4. Eo modo quo in proportionibus rectangulorum ad propof. 8. & seqq. hujus c. factum est.

Si primo loco sit tangens, secundo vel tertio radius; tangens cum radio commutent loca, sed ut vicem tangents obtineat tangens complementi per p. 41. & 42. c. 4. Quo modo sepe in hujus c. prop. citatis factum est.

Si primo loco sit secans, secundo vel tertio radius, commutentur loca, sed vicem secantis obtineat Sinus complementi per p. 45. & 46. c. 4.

II. Si primo loco sit radius, secundo & tertio sinus, pro sinuum arcubus assumpta eorum complementa, sunt  $\Delta$ li rectanguli latera ang. rectum includentia, ac proinde prosthaphære. sin p. 15. c. ult. admittentia.

Ut in schemate ex prob. 8. resumpto si detur Triangulum  $IKH$ , in quo ex datis angulo  $H$ , hoc est, ejus mensura  $BQ$ , & hypotenusa  $HK$ , querendum sit latus  $KI$ . Assumptis arcuum  $HK$  &  $BQ$  complementa

$N$

$KQ$

KQ & QC per prosth. p. 15 invenitur in  $\Delta$ lo QKC  
 tertii lateris KC complementum l K hoc est latus  $\Delta$ i K  
 IH quæsitum. Suprà pag. 178. radiū fuit exemplum  
 investigatæ declinationis Solis ex aëris hypotenusa HK 60  
 gr. & arcu BQ 23 gr. 31' m & inveniebatur pro sinu  
 lateris KI 34567. Eundem sinum inveniemus simplici  
 prosthaphæresi, si pro datis arcubus assumantur eorum com-  
 plementa 30 gr. & 66 gr. 28' m. Nam

$$\begin{array}{r} \text{QC } 66^{\circ} 28' 30'' \text{ complem. } 23^{\circ} 31' 30'' \\ \text{QK } 30^{\circ} 0' 0'' \text{ ————— } 30^{\circ} 0' 0'' \end{array}$$

$$\begin{array}{r} \text{Summa } 96^{\circ} 28' 30'' \quad \text{Summa } 53^{\circ} 31' 30'' \text{ sinus } 80417 \\ \text{Excessus } 6^{\circ} 28' 30'' \text{ ————— } \text{sinus } 11277 \end{array}$$

Relid. 69134

Semissis est sinus quæsitus 34567

III. Si primo loco sit radius, reliquis sinus,  
 tangentes aut secantes sive purè sive mixtim; à  
 tangentibus & secantibus ad dextram tot cha-  
 racteres, quot Radius cyfras sive circulos ha-  
 ber, abscissi assumantur hypotheticè ut sinus, &  
 sic utriusque sinus inquirantur arcus, quorum  
 arcuum complementa præsupponantur ut la-  
 ra Trianguli prosthaphæretici, cujus terminus  
 quartus quærat: huic per regulam præce-  
 dentem invento si productum è caractere al-  
 terius termini proportionalis sinistro primùm  
 relictis in totum proportionalem reliquum  
 multiplicato addatur; prodibit Sinus, Tangens  
 aut Secans quæsitæ.

Pitiscus hæc proponit de datis cum Radio Sinibus Tan-  
 gentibus aut Secantibus mixtim, hoc est, ut alter terminus

fit

fit Sinus alter Tangens aut Secans sed experiemur idem etiam v. lere si uterq; terminus fuerit vel Secans vel Tangens, aut alter tangens alter secans. Regula nostra satis perspicua est, saltem addamus exempla.

Pag 179. investigavimus Ascensionem rectam 20 gr.

¶ triplici proportionione.

Prima fuerunt hi termini: Radius 1000000: Tangens 229710: Tangens 36838: quartus inventus erat 84620: Sinus. Hunc Sinum via quoque prosthaphareutica sic inveniemus.

Quinque dextri characteres sunt

2 | 29710 sinus 17 17 " Complém. 72 43  
| 36838 sinus 21 36 54 complém. 68 23 6

Hac complementa sint latera  $\Delta$ li hypothetici:

72 43	0	Complém.	17 17 0	
68 23	6		68 23 6	
<hr/>				
141	6	6	85 40 6	sinus 99714
51	6	6		sinus 77826
<hr/>				
		36838		Summa 21888
		2		Semissis 10944
		73676		73676
<hr/>				
Sinus quæsitus 84620				

Secunda proportionis termini fuerunt hi: Radius 1000000: sinus 93835: secans 2000000: & quartus inventus erat 187670 Secans. Hac ista proportione expeditius inveniebatur quam prosthapharepsi: Sinus enim 93835 per 2 multiplicatus exhibet quæsitum. Prosthapharepsi:

2 | 00000 sinus 0 0 0 Compl. 90 0 0  
 | 93835 sinus 69 46 38 compl. 20 13 22

90 0 0 Compl. 0 0 0 93835  
 20 13 22 ——— 20 13 22 2

10 13 22 20 13 22 sinus 34567 187670  
 20 13 22 ——— sinus 34567 Subtr.

Restat nihil: ergo Tangens quæsitæ 187670.

Tertiæ proportionis termini erant isti: Radius 100000:  
 Sinus 91688: Tangens 173205: & inveniebatur tan-  
 gens 158808. Hanc etiam inveniemus pro haphæreæ:

2 | 73205 sinus 47 330 Compl. 42 56 30  
 | 91688 sinus 66 28 30 Compl. 23 31 30

42 56 30 Compl. 47 330  
 23 31 30 ——— 23 31 30

66 28 70 35 sinus 94313  
 23 32 ——— sinus 39928

Summa 134241  
 Semissa 67120  
 Sinus datæ 91688 Add.

Tangens quæsitæ 158805

Quid si verò non unus tantum sed & alter proportio-  
 nalium terminorum sit & vel plurium characterum? tunc  
 Δlo hypothetico, ut in cæteris, prius resolutio, multiplicen-  
 tur alternatim character termini unius superflui in alte-  
 rius dextros abscissos: productorum summa addita invento  
 Δli hypothetici patefacit quæsitum. Exemplum: Suinto  
 præter radium datæ Secantes 1147372 & 386370

et huius character superflui in terminum pri-  
 orem integrum productorum summa. &c.

ut proveniat secans: 4433101. Hanc etiam venabimur  
prostapharenicè:

$$\begin{array}{r} 11 \mid 47372 \text{ sinus } 28 \ 16 \ 17 \text{ Complem. } 61 \ 43 \ 47 \\ 3 \mid 86370 \text{ sinus } 59 \ 44 \ 4 \text{ Complem. } 30 \ 15 \ 56 \end{array}$$

$$\begin{array}{r} 61 \ 43 \ 47 \text{ Complem. } 28 \ 16 \ 17 \\ 30 \ 15 \ 56 \qquad \qquad 30 \ 15 \ 56 \end{array}$$

$$\begin{array}{r} 91 \ 59 \ 43 \qquad \qquad 58 \ 32 \ 13 \text{ sinus } 85297 \\ \text{Excel. } 1 \ 59 \ 43 \qquad \qquad \text{sinus } 3482 \end{array}$$

$$\begin{array}{r} \text{multip. } 86370 \qquad 1147372 \text{ Relid. } 81815 \\ \text{per } 11. \ 86370 \qquad \qquad 3 \text{ Semiss } 40907 \\ \hline 950070 \qquad 3442116 \\ 3442116 \qquad \qquad \qquad 4392186 \\ \hline 4392186 \end{array}$$

$$4433 \ 93 \text{ Sec.}$$

questita: à priori deficiens octonario quæ differentiola ne  
quidem unico scrup. tertio calculum turbat, siquidem hæc  
secans reperitur in tab. iura 4407746 & 4464980,  
ubi demum diff. 57234 resp. unico sc. 1. sive 3600 tert.

Si quis rationem huius prostapharenici calculi deside-  
ret, etiam hanc dabo. In primo exemplo juxta proportionem  
usitatas multiplicanda essent 229710 cum 36838, pro-  
ductumq; sinu toto dividendum: sed assumtis utriusq; nume-  
ri tantum 5 dextris notis ad calculum prostapharenicum  
idem est ac si 36838 in 29710 multiplicata in sin. in to-  
tum dividantur ut experienti perspicuum (provenit n ex hæc  
operatione 10944, quod etiam provenit ex  $\Delta$ lo hypothe-  
tico) & ex calculo reg. 2. collato c pūoport. pag. 179. vi-  
dere est. Cum igitur hoc modo 36838 tantū sint multiplica-  
ta per 29710, debebant a. p. 229710, necessarii restas  
multiplicatio 36738 per 2, ut productū producto 10944.



ex 36838 & 29710 addantur. Idem de tertio exemplo judicandum. In ultimo prosthaphæreticè multiplicata tantum sunt 47372 per 86370, cum debuissent per 386370, & istud non solum debuissent multiplicare 47372, sed 1147372: restat igitur ut adhuc 1147372 multiplicetur per 3, & ut 11 adhuc multiplicemur per 86370, ut summa productorum producto priori addatur. Dices autem, inconvenienter productum hoc ultimum sive productorum summam subscribi producto priori per prosthaphæreticum: quia namq; istud inventum est Quotiens numeri per radium divisi, sequitur ultimum productum multiplicatis addendum subscribi characteribus sinistris, cum Arithmetica jubeat dextris. Sed vide convenientiam:

$$\begin{array}{r}
 36838 \\
 229710 \text{ Omnes multiplicantis} \\
 \hline
 368380 \text{ characteres multiplican-} \\
 257866 \text{ runt excepto primo} \\
 331542 \text{ sive sinister-} \\
 73676 \text{ simo,}
 \end{array}$$

10944 | 56980 (ti, ut decet.  
 73676 | Multipl. sinisterrimi subscripta suo multiplican-  
 84620. summa.

Puto me satis declarasse Problema hoc prosthaphæreticum: restat ut de abscissione & characterum dexteriorum id moneam, eam esse directam ad hasce tabulas minores à nobis editas, in quibus Radius & continet cyfras 2 ubi verò quis tabulis usus fuerit, quarum Radius 7 aut plures cyfras habuerit, tum, quod regula tertia indicat, ne cogites se adstrictum ad numerum quinarium, sed ad eum, quem radius, quo utitur, supponatur.

Et

Et hic finis esto doctrinæ Triangulorum  
 compendiosè nobis conscriptæ, sic tamen ut in  
 isto compendio, quod spero, nihil ad utilem  
 calculi praxin ejusque demonstrationem & ge-  
 nuinum tabularum intellectum desideretur.  
 Manuale hoc est & portatile proutarium: quo  
 studiosos Mathematicæ sublimioris deducimus  
 ad Scripta Regiomontani, Finckii, Landsper-  
 gii, Pitisci, Adriani Romani, Clavii, Magi-  
 ni, & ad consummatum illud Opus  
 Palatinum Rherici.

FINIS  
 TRIGONOMETRIÆ.



# AUCTUARIA

Duo:

PRIVS

DE MENSURANDIS PER  
QUADRANTEM ET SEMI-  
CIRCULUM LINEIS

RECTIS;

POSTERIUS

DE SUPPUTANDIS LOCO-  
RUM TERRÆ DISTANTIIS  
GEOGRAPHICIS.

*Ad usum Trigonometriae familiarem  
demonstrandum subjuncta.*





# DE ALTITUDINIBUS ET LONGITUDINIBUS per Quadrantem aut Semicirculum dimetiendis.

AUCTUARIUM DRTUS.

**I**nter ceteras, quæ hodie studiosius excoluntur, materias Mathematicas & hæc est. Nullis ferè mundanis non videas novorum instrumentorum novos apparatus, novos editos tractatus, etiam speciose typis aeneis ornatos. Ac iste quidem aeneo figuræ semper jacent oculos, hæud semper animos. Quis enim inter multos istarum figurarum aeneis depictarum dimensionum & regularum catervatim de his traditarum rationem reddit? ita lector ἀγεωμέτρητος, nisi libellum istum assidue secum portet, memoria mandare cogitur omnes & singulas istas de singulis casibus regulas: universalem autem unam cerebro imprimere ignorat. Sed reperias etiam egregia ignorantie compendia, desidia fomenta. quanam? instrumenta, quorum beneficia omnis linearum dimensio sine ulla numerorum supputatione, si Dis placet, absolvitur. Organa profectò gemmis & auro redimenda, si tutè certòq; præstarent id, quod magnificè pollicentur. Ergo verò nullum eorum adhuc vidi (vidi, modestè dixerim, non paucatum à Germanis tum ab Italis & Gallis edita) quod omnibus dimensionum casibus suffecerit. Omnibus autem casibus idoneus & sufficiens est Circulus aut saltem semicirculus partibus suis Geometricis divisus, sed globulo supra fulcrum adaptato circumvolubilis, cujus adornatio commodius oculari fabrica quam delineatione ebartacea docetur.

Hujus

Hujus Semicirculi sive dupli Quadrantis usum in dimensione linearum rectorum hic subjungam: non quidem omnium dimensionum casus explicaturus, sed saltem in maxime frequentibus usum Trigonometrie planorum ostensurus.

Principio igitur omnis dimensionis hoc tibi fundamentum esto:

I. In omni legitima dimensione offerunt sese duo Triangula similia, angulo communi ante mensuris oculum concurrentia; unum minus in instrumento mensorio; alterum majus in aëre: ita ut ubicunque hæc duo Triangula non dantur, dari nequeat genuina dimensio. Omnis enim linea mensuranda est unum latus Trianguli majoris, proportionale homologo lateri minoris, per p. 13. c. 3.

Quid sint triangula similia, vide p. 11. c. 3. homologa similibus Triangulorum latera sunt æquales angulos comprehendentia, de quo p. 13. ejusdem c. Ceterum quomodo  $\Delta$ la similia sint in praxi mensoria, ad singulas dimensionum regulas monstrabimus.

II. Linea deinde mensuranda vel est altitudo vel longitudo.

Nomulli tertiam speciem addunt, Latitudinem: sed hæc propriè est Longitudo transversim aspecta.

III. Altitudo est linea horizonti perpendicularis: longitudo est in ipso horizontis plano vel eidem parallela.

IV. Alti-



*IV. Altitudo mensuratur collimando aut ex inferiori loco ab altitudine nonnihil remoto in altitudinis apicem; aut contrà ex apice in locum istum inferum seu terminum subjæctæ distantiae.*

*V. Verobiq; si loci istius distantia ab altitudine sit mensurâ populari præcognita, dimensio absolvi-  
tur statione & collimatione unica; sin minus;  
duabus.*

*Requiritur autem, ut ista distantia sit altitudini perpendicularis. Aliàs simul explorandum est aut præcognoscendum, quantum sit altius aut humilius altitudinis fundamentum quam locus è quo vel ad quem sit collimatio.*

*VI. Ex una statione Canones dimensionum  
hi sunt.*

*1. Si visus fuerit ex inferiori loco per pinnas Quadrantis aut Semicirculi tam fixi quam pensilis in apicem altitudinis; erit ut Sinus Totus ad Tangentem arcus abscissi sive anguli observati, sic distantia mensoris ab altitudine est ad altitudinis partem, quæ cum altitudine fulcri quadrante sustentantis, sive cum altitudine collimantis oculi à terra, totam componit altitudinem quæsitam.*

*Duplex est Quadrans & Semicirculus; fixus, qui fulcro affigitur immotus, regulâ cum pinnaculis mobili; & pensilis, qui manibus tractatur ipse mobilis, cujus pinnaculia sunt in alterutro latere, sic ut collimatione factâ perpendiculum è centro liberè dependens vice regule gradus observatos indicet. Ego multis de causis pensili præfero si-*



rum, cujus latus alterutrum ante praxin adminiculo perpendiculari dirigatur ut altitudini fixi parallelum. Quo facto & collimatione juxta Canonem instituta (poteris autem centrum quadrantis fixi vel suo sum vel deorsum vertere, ut hic vides: arcus enim DE sive anguli verticales DCE utrobique sunt aequales per p. 21. c. 2.) collocentur in regulam proportionum 1. CD sinus totus, 2. DE tangens observati arcus DE sive anguli DCE, 3. distantia CG. Operatione peracta proveniet altitudinis pars BG, cui addita GA hoc est (per p. 14. c. 2.) CH altitudo fulcri, producit totam altitudinem quaesitam AB. Esto distantia AH vel GC 45. cubit. Arcus observatus DE 36 gr. 40 min. Altitudo fulcri 2½ cub. Erit ut 100000 Ad 74447 Tang. 36 gr. 40 min. Sic 45 cub. ad 33½ cub. quibus additi 2½ provenit altitudo tota 36 cubit.

Sunt enim hic duo  $\Delta$ la familia, CDE & CGB in Quadrante fixo manifestissima propter angulos rectos ad G & D (ED perpendicularis est ad CG per p. 35. c. 4. BG vero propterea, quia omnes altitudines materiales ab Architectis eriguntur ad perpendicularum) & propter communem ad C cui in inferiori quadrante aequatur verticalis DCE per p.

21. c. 2. Ergo in Triangulis hisce per p. 11. c. 3. similibus  
erit per 13 ejusd.

VicD ad DF: Sic CG ad GB vel

VicD ad CG: Sic DF ad GB.

In Quadrante pensili hac duo  $\Delta$ la quoque sunt similia  
licet non similiter sita.

Nam  $\Delta$ lum C i E  $\Delta$ lo CDF est simile per p. 12. c. 3.

Eidem C i E simile est C i V & angulus observationis CV  
equalis angulo i CE per p. 18. c. 3. ergo utriq; tangens DF  
etque ita perinde est sive per p. 13. c. 3. dixeris

Ut Vi ad iC, sic VG ad GB; sive

ViCD ad DF, sic VG ad GB.

Hac est vera demonstratio dimensionis altitudinum;  
quam si fideliter perceperis, simul rationem dimensionis di-  
stantiarum percepisti, ut suo loco audies.

Vides hic etiam, cur ad altitudinem ex operatione pro-  
venientem addere cogaris altitudinem fulcri: parallelo-  
grammum enim GCH A planè exclusum est à proportiono  
 $\Delta$ lorum nisi planè supinum te cum instrumento prostraveris.  
Si Altitudo materialis fuerit notabilis crassitie, in conum  
seu wucronem desinens, distantiam GC vel AH non simplici-  
ter sumendam à pariete vel circumferentia altitudinis, sed  
ex interiori centro. Quod quæ ratione fiat, attendendo. Si,  
e. g. turris fuerit baseos circularis, peripherie exterioris  
parte sextam pro semidiametro turris accipe: aut si non da-  
tur circuitio, internam mensurato diametrum, cuius semisse  
adde crassitiem muri. Sin turris fuerit baseos quadrangula  
(semper sunt parallelogramma, & plerumq; rectangula) li-  
nea ex angulo in angulum oppositum semisse crassitudini mu-  
ri additam, sine notabili errore pro crassitie turris assumere  
liceat. Cetera sublimiora te docebit usus.

2. Si

VII. 2. Si Visus fuerit per pinnas è summo altitudinis in terminum subiectæ distantie; erit Vt Sinus Totus ad Tang. complementi arcus vel anguli observati, sic distantia ad totam altitudinem.

Hic non necesse est altitudinem fulcri addere. Fit enim visio ex L per O in H. Arcus observatur PO cuius complementum ON & huius tangens NQ. Sit distantia KH 40 cubitorum & arcus observatus PO 43 $\frac{1}{2}$  gr. Eius igitur complementum ON est 46 $\frac{1}{2}$  gr. cuius tangens NQ 105378. Erit

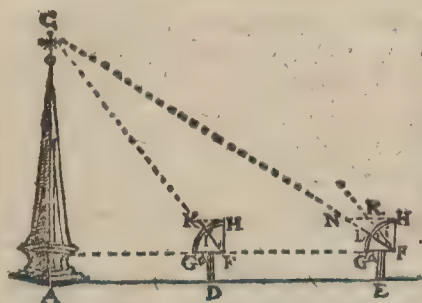
$$\begin{array}{ccccccc} \text{Vt LN} & \text{Ad NQ} & \text{Sic HK} & \text{Ad KL} \\ \hline 100000 & \text{---} & 105378 & \text{---} & 40 & \text{---} & 42 \text{ proximè.} \end{array}$$

Triangula enim LNQ & LKH similia sunt propter rectos ad N & K & propter alternos ad L & H (recti in L H incidens in parallelas LN & KH facit eos angulos æquales per p. ult. c. 2.) Ergo per p. 13. c. 3.

Vt LN ad NQ Sic HK ad KL, & alternè. Demonstrationem in quadrante pensili prudens omitto, cum è viced. prop. constet, omnia in fixo demonstrata locum etiam habere in pensili.

VIII. Dimensio è duabus stationibus absolvitur hac proportionem: Si visione è duabus stationibus, in eadem horizontis linea sitis, ad apicem altitudinis tantà observatorum arcuum complementa complementorumq; tangentes inquirantur; erit ut differentia tangentium ad Sinum totum, sic differentia stationum ad altitudinem, excepta fulcri quantitate, totam.

Esto



Esto men-  
 suranda altitu-  
 do AC pyra-  
 midis, cujus di-  
 stantiam à D  
 vel E propter  
 interjacentia  
 fortè adificia  
 vel aia impe-  
 dimenta igno-

res. In prima ergo statione D observato arcu GI, ex.  
 gr. 49 gr. recede in alteram stationem E, (quæ cum prima  
 sit in eadem horizonis linea ADE) similiterq; observato  
 hic arcu GL 37 gr. inquire utriusque arcus observati G  
 L & GI complementa LH 41 gr. & LH 53 gr. eorumq;  
 tangentes HK 86929 & HN 132704: eritq; diffe-  
 rentia Tangentium NK 45775. Differentia stationum  
 esto 75 cub. Proportio jam talis est: Vi NK 45775 ad  
 HF 100000, sic FF vel ED diff stationum 75 cub. ad  
 B. 1647 proximè:  $\Delta$ la enim obliquangula NKF & F  
 FC, quarum altitudines per p. 26 c. 1. sunt HF & BC,  
 similia sunt: siquidem rectæ KF in utraque statione propter  
 æquales arcus GI sunt parallele, in quas recta CF, ex apice  
 altitudinis mensuranda ad centrum Quadrantis in secunda  
 statione incidens, facit angulos alternos FCF & NFK  
 per p. ult. c. 2. æquales: sic & parallela NH & GF faciunt  
 æquales KNF & NFG acutos, item NKF & FFC ob-  
 tusos. Igitur per p. 13. c. 3. non tantum est Vi NK ad KF,  
 sic FF ad FC (à prima statione in apicem) sed etiam ut  
 NK ad HF, sic FF ad BC.



Quod si in hoc casu divisionem evitare velis, inquire differentia Tangentium quasi peculiaris tangentis competentem arcum, e.g.  $24^{\circ} 35' \frac{1}{4}$  min. ejusq; utrum complementi  $65^{\circ} 24' \frac{1}{4}$  min. tangentem  $218461$  multiplicaper differentiam stationum  $75$ , productumq;  $16384575$  divideper sinum totum, & habebis quotientem  $163^{\circ}$  ut prius. Inveniam jam  $CB$   $163^{\circ}$  adde altitudinem fulcri a  $D$  vel a  $E$  vel  $B$ , ex gr  $2^{\circ}$  cubit. & habebis altitudinem totam  $AC$   $166^{\circ}$  cubituri.

*IX. Sequitur dimensio longitudinis, primò ex una statione:*

Si visio fiat per pinnas ex uno longitudinis termino in apicem altitudinis ad alterum terminum erectæ; erit ut Radius ad tangentem complementi arcus, sic altitudo quantitate fulcri diminuta ad distantiam. Sin visio fiat ex altitudine in alterum distantie terminum; erit ut Radius ad tangentem arcus, sic altitudo ad distantiam.

Requiritur hîc præcognita quantitas altitudinis, ad cuius apicem per pinnas sit visus, sicut in dimensione altitudinis ex una statione requirebatur cognita distantia. Repetito igitur isto diagrammate (exemplo numerali non est opus) si visio fiat ex  $C$  in  $B$ , erit in  $\Delta$ is  $RTC$  &  $CGB$ , propter rectos ad  $T$  &  $G$  & propter alternos ad  $C$  &  $B$  similibus, Vt  $CT$  Radius ad  $T$  & tangentem complementi arcus  $DE$ , sic  $BG$  ad  $G$ . Sin fiat visio superne ex  $L$  in  $H$ , erit ut  $LP$  ad  $P$  S, sic  $LK$  ad  $KH$  propter  $\Delta$ la  $LP S$  &  $LKH$  manifestè similia similiterq; sita.

*X. E dua-*

X. E duabus stationibus dimensio fit bifariam, prout videlicet accessus ad alterutrum distantiarum terminum datur, aut non datur.

XI. Si datur accessus, datur simul aut non datur inter termino altero perpendicularis altitudo, ad cuius apicem proffici possit.

Tamque facta Geometrica visione, una è termino distantiarum, altera è loco remotiori, in unam tamen cum distantia lineam incidente, Si arcum observatorum inquirantur complementa complementorumque tangentes, erit ut differentia tangentium ad tangentem minorem, sic differentia stationum ad quæsitam distantiam. Aut si statio secunda sumi nequeat loco remotiori sed in ipsa distantiarum linea, erit ut differentia tangentium ad tang. maiorem, sic differentia stationum ad distantiam quæsitam.

Hæ proportionēs manifeste sunt è diagr. proximè præcedente. Si namq, proposita sit distantia  $AD$ , facta planè ubi è stationibus  $D$  &  $E$  visione est ut  $NK$  ad  $KH$ , sic  $FF$  ad  $FN$ , hoc est,  $DA$ . Nam in Triangulis similibus  $NH$  &  $FBC$  ut tota  $NH$  ad totam  $FB$ , sic pars  $NK$  ad homologam partem  $FF$ , & alternè.

Si verò distantia proposita sit  $EA$ , ita ut statio secunda  $D$  propter fortè paludes, aut alia in recessu impedimenta necessariò sumenda sit in ipsa distantia linea, erit in iisdem Triangulis ut  $NK$  ad  $NH$  sic  $FF$  ad  $FB$  sive  $EA$ .

Exempla faciliè è superius ad figuram applicato huc desumi possunt.



IAE propter angulos ad A & O rectos & propter communem ad I similebus, est per. sap. cit. p. 13. c. 3. Vt IO ad O I, sic IA ad AE; & alternè.

ET HACTENUS QUIDEM TUTUS  
 QUADRANTIS USUS: DEINCEPS  
 TUTIUS ADHIBERE SE-  
 MICIRCULUM.

*XIV. Sin statio ad distantiam perpendicularis  
 haberi nequit;*

E prima quidem statione siue alterutro di-  
 stantiæ termino fiat visio tum ad alterum termi-  
 num tum ad secundam stationem; & secunda ad  
 utrumq; distantiæ terminum. Tunc enim si duo-  
 rum angulorum observatorum complementum  
 inquiretur ad duos rectos, Vt complementi si-  
 nus est ad differentiam stationum, sic erit sinus  
 anguli secundæ stationis ad distantiam quæ sitam.



Jam non habes duo  $\Delta$ la similia  
 rectangula sed unum obliquangulum  
 qualecunque, e.g. ABC: Vbi quæri-  
 tur de latere AB. Fiat igitur visio è  
 prima statione A in terminum alto-  
 rum B & stationem secundam C: &  
 secunda deinde statione C fiat visio in  
 utrumq; distantiæ terminum A & B.  
 Quo facto dantur in hoc  $\Delta$ lo duo an-  
 guli A & C per observationem & la-

tus interjectum AC. Iam ex p. 7. c. 6. tibi notum est, an-  
 gulis duobus datis dari simul tertium ad B, utpote comple-

mentum summa duorum ad semicirculum sive duos rectos. Igitur per p. 15. c. 6. Ut sinus anguli B est ad latus oppositum sive differentiam positionum AC : sic sinus anguli C est ad latus oppositum sive distantiam quæsitam AB

XV. Restat mensuranda distantia sive longitudo ad cuius neutrum terminum datur accessus : quam alii *Leititudinem* improprie vocant.

XVI. Requirit præcognitam utriusque termini à certo mensuris loco distantiam quam radium opticum dicimus, simul & angulum alterutro radio optico, & longitudine quæsitæ comprehensum.

XVII. Distantia terminorum exploratur regulis modò traditis : angulus autem ex observato alio angulo radiis opticis intercepto :

Nam ut summa radiorum opticorum est ad eorundem differentiam ; sic tangens dimidiæ reliquorum præter observatum angulorum summæ est ad tangentem differentiæ à dicta dimidia summa subtrahendæ, ut prodeat angulus minor ; aut addendæ, ut prodeat major. per p. 17. c. 6.

XVIII. Cognitis demum angulis, Ut sinus alterutrius eorum est ad radium opticum oppositum, sic sinus anguli observati est ad longitudinem quæsitam. per p. 15. c. 6.

Hæc dimensio nonnihil difficultatis præbet minus in Geometria exercitatis. Sumo urbis alicujus due turres aut alia loca A & B, quorum distantia è castris ad urbem locatis exploranda. Per regulas antecedentes exploretur à certo aliquo





Duo ang. recti 180 gr.

angulus C 47 gr.

BC 70—70

AC 65—65

Summa ang. A &amp; B 133 gr.

Semissis 66 gr. 30 m.

135 — 5 — Tangens 229984. Operatione  
 peracta provenit 8518 Tangens 4 gr. 52 m. que addita  
 usurpata semissi 66 gr. 30 m. producit angulum A ma-  
 jorem (qui nempe majori lateri CB opponitur) 71 gr. 22  
 m. Jam porro Vi hujus anguli sinus 94759 est ad latus op-  
 positum CB 70 vers. Sic anguli observati C sinus 73135  
 est ad latus oppositum sive distantiam questam AB 54  
 pertic.

N3 Quod si cui nimis laboriosus videtur iste calculus (de-  
 bet autem nomini Geometriam amanti) is in orichalco  
 vel equabili charta mechanice constituit angulum C an-  
 gulo observato equalem, & crura CA & CB adhibuit  
 sca à vel instrumento partium usitato continuet ad propor-  
 tionalem crurum realium quantitatem: tunc enim distan-  
 tia AB circino in scalam traducta manifestatur.

Et hac de dimensione linearum rectarum ad usum cal-  
 culi Triangulorum planorum ostendendum addidisse suf-  
 ficiat. Plura reperiuntur in Geometria nostra  
 publicis praedictionibus tra-  
 dita.

DE DISTANTIIS LOCORUM  
terræ Geographicis supputandis

AUCTUARIUM POSTERIUS

**A**uctuaria priori monstravimus usum doctrinae Triangulorum planorum: æquum est ut etiam sphericorum usum ostendamus, & quidem non in Astronomicis, ubi multo latior est eorum usus, sed in Geographicis, ut in familiarioribus & usui civili propioribus. Esi verò Distantia locorum Geographica sine Triangulorum sphericorum doctrina supputari solent à plerisque, qui de sphaera mundi libellos conscribunt, autoribus: tamen iste ab illis præscriptus calculus nec adeò iustus est, nec expeditus, quæ de re alibi. Nos calculum nostrum immortis Trigonometria demonstrationibus fundatum perspicuè simul & breviter proponemus.

I. Distantia locorum Geographica est arcus circuli sphaeræ terræ maximi inter data loca comprehensus.

II. Determinatur itaque gradibus & minutis Geometricis, in stadia postmodum aut milliaria convertendis.

III. Conversionis fundamentum ex eo est, quod singulis gradibus respondeant milliaria Germanica 15, unde quaternis minutis respondent milliaria singula.

Præsertim ab experientia est: comprobatum habetur, iter faciendis rectâ versus septentrionem aut meridiem ad quinquena semper milliaria polum elevationem reddi magis

gro gradu. Posterius è priori colligitur : nam si 60 minutis respondent mill. 15, ergo 4 minutis resp. 1. milliare inventa igitur in gradibus & minutis locorum distantia, si gradus multiplices per 15, scrupula verò divides per 4, summa productorum exhibet distantiam locorum in miliaribus. Id quod hîc semel admonitum posthac semper observa.

IV. Est autem distantia locorum triplicis generis, prout videlicet loca differunt vel latitudine vel longitudine vel utraque.

V. Latitudo loci est distantia ejus ab æquatore, semper æqualis elevationi poli : mensuratur arcu meridiani inter æquatorem & locum terræ datum intercepto.

Quod in cælis est declinatio stellæ, hoc in terris est latitudo loci : scilicet utrumq; distantia ab æquatore. Hæc in terris est semper æqualis elevationi poli : nam si super æquatorem terrestrem habites, cælestis per verticem tuum transit : si pervenias ad polum alterutrum terrestrem, verticalis tibi polus cælestis est : ergo quantum ab æquatore terrestri versus alterutrum polum recedis, tantum iste tibi polus supra horizontem elevatur.

VI. Longitudo loci est distantia ejus à primo meridiano per Insulas olim Fortunatas, hodie plerunque per Flandricas, ducto : hæc mensuratur arcu æquatoris inter meridianum primum & meridianum dati loci intercepto.

De primo Meridiano multa necessaria differendi alibi dabitur occasio.

*Saltem*

LOCORUM DISTANTIIS. 225

*Salem id hoc loco notetur, Ptolemaeum & veteres Me-  
ridianorum ordinem numerasse ab eo qui per Ins. Fortu-  
natas transit, recentiores plerosque per Azores sive Ins.  
Flandricas: ideoque in duorum locorum longitudine des-  
ignanda utriusq; loci longitudo ex eodem Catalogo ad eun-  
dem terminum collecto sumatur.*

CONSECT. Itaque differentia longitudinum est  
arcus æquatoris inter meridiānum utriusque loci com-  
prehensus; semper semicirculo minor.

Ideoque si Catalogis vel tabulis reperitur major se-  
circulo, complementū ejus ad integrum circulū usurpatur.

VII. Longitudinum ac Latitudinum Catalogi  
passim habentur in libellis sphericis & Ephemer-  
idibus autorum complurium.

VIII. Distantiæ locorum, sola latitudine differentium supputandæ regula hæc est:

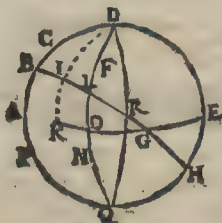
Si locus tantum alteruter ab æquatore distet; ejusdem latitudo simpliciter exhibet distantiam locorum quæsitam: si utriusque latitudo sit versus eundem polum; differentia latitudinum est distantia quæsitæ: si alterius latitudo sit borealis, alterius austrina; summa latitudinum est distantia quæsitæ.



Non igitur hic ulla Trigonometria opus est. In praesentii hemisphaerio, circulus completus est meridiana locorum CBAP: AKGE est aequator, cujus poli D & Q. Primum igitur loca A & O nullam habet latitudinem; ideoque si ad A comparetur locus B vel C vel P, latit. CA vel BA



vel  $PA$  est ipsa distantia quaesita: sic  $\odot FO \odot LO \odot NO$  est distantia locorum  $F \odot O, L \odot O, N \odot O$ . Secundo si queratur distantia locorum  $B \odot C$ , latitudo minor  $BA$  subtracta à majori  $CA$  relinquit distantiam  $CB$ : quod idem intellige de locis  $F \odot L$ . Tertio si queratur distantia locorum  $B \odot P$ , vel  $C \odot P$ , summa latitudinum  $BA$  vel  $CA \odot PA$  est distantia quaesita: quod etiam intellige de locis  $L \odot N$  vel  $F \odot N$ . Exempli gratia, Dantiscum  $\odot$  Torunium eidem subjacent meridiano, sed latitudo Dantisci est 54 gr. 24 min. Toruni 53 gr. 12 m. utraque borealis: ergo differentia 1 gr. 12 m. in milliaria conversa prabet Geographica distantiam 18 milliarium, cum tamen iter usitatum addat adhuc duo.



Sic Toletum Hispania  $\odot$  Oxonium Angliae eandem habent longitudinem: sed Toleti latitudo est 39 gr. 55 m. n. Oxoni 51 gr. 51 m. utraque borealis: differentia 11 gr. 56 m. quo facit milliaria 179.

Quaritur quantum distet Africa promontorium, Capo de Palmas dictum, ab opposito Magellanico promontorio sub eadem longit. sito. Illius latitudo est 3 gr. 30 m. borealis: hujus autem 47 gr. 30 m. australis: summa 51 gr. facit 765 milliaria.

**IX.** Locorum sola longitudine differentium distantia supputatur his regulis:

I. Si loca sint sub æquatore, differentia longitudinum est ipsa distantia quaesita.

## LOCORUM DISTANTIIS. 227

Ut in precedenti figura loca E, & G, G & O, O & A & C.  
 Exempli gratia queratur quantum distet Insula S. Thoma  
 (medium scilicet insulae) ab occidentaliſſimo ostio magni A-  
 mazonom fluminis in America, Rio grande de las Amazonas  
 dicti & Caraban in à Brasilia dirimentis. Virumq; locum  
 datum Aequator transis: ac juxta Mappas Fansonii qui pri-  
 mum meridianum per Insulas Corvo & Flores ducit, Insu-  
 la S. Thomae longitudo est  $43^{\circ} 2'$  gr. dicti autem ostii longitudo  
 $345^{\circ}$  gr. differentia  $301^{\circ}$  r. quaecum sit major semicircu-  
 lo, complementum ejus  $58^{\circ}$  r. patefacit distantiam qua-  
 sitam, scil. mill  $877^{\frac{1}{2}}$ .

X. 2. Si sint extra Aequatorem (intellige-  
 verius eundem polum, alias calculus est idem  
 cum omnium ultimo casu) erit Ut unus totus  
 ad sinum complementi communis latitudinis,  
 ita sinus semidifferentiae longitudinis ad sinum  
 semidistantiae quae sitae. Aut si communis latitu-  
 do & complementum semidifferentiae longitu-  
 dinis assumantur, Triangulum sit rectangulum  
 quo per p. 15. c. 7. sola prosthaphæresi soluto  
 prodit sinus semidistantiae.

Sunto data loca B & L, quorum latitudines BA & LO  
 sint aequales, ita ut Triangulum B D L sit aequicurum. Di-  
 misso perpendicularo D I K bisecante differentiam longitudi-  
 nis O A (mensuram anguli D) in K simul & Trianguli da-  
 ti basin B L in I, sunt duo Triangula B I D & I D L ad E  
 rectangula & penitus aequalia, in quorum unoquoque per p.  
 8. c. 7. est ut sinus anguli I, sinus totus, ad sinum hypotenu-  
 sa L D sive B D, sic sinus anguli I D L aut I D B ad sinum  
 lateris

lateris LI vel IB, cujus duplum LB est quæſita diſtanti-  
a LB.

Aut ſi IL & KO continues in G, ut GI & GK ſint  
quadrantes, habes  $\Delta$ lum GOL per p. 18. c. 2. ad O  
rectangulum, in quo ex datis lateribus circa angulum re-  
ctum LO & OG ſola proſtaphæreſi per p. 15. c. 7. invenire  
poſes latus tertium GL, cujus complementum LI eſt ſemidi-  
ſtantiæ quæſita: invenies autem, ut praxis te docet, illic ſi-  
num arcus IL tanquam complementi tertii lateris.

Exemplum. Inſularum Flandricarum caput eſt Ter-  
cera, quam peritiſſimus ille Iohannes Hugo van Lins-  
ſchote: ſcribit ſitam ſub eadem altitudine (ut loquuntur  
nauta, ſubintellige Poli) cum Liſibona Luſitania.

Huius latitudo eſt 38 gr. 40 min. longitudo Tercera  
juxta Fanſnium 4 gr. longitudo Lyſibona 22 gr. 40 min.  
differentia longit. 18. gr. 40 min. ſemiſſis 9 gr. 20 min.  
Numerorum locatio juxta p. 8. c. 7. talis eſt:

Radius Sinus 51 gr. 20 Sinus 9 gr. 20. min.  
min. compl. com- ſemidiſſ. longit.  
mun latit.

---

100000 ——— 78079 ——— 16218. Operatione  
peracta provenit 12663 ferè, Sinus ſemidiſtantiæ 7 gr. 16  
min. 27. ſec.

At juxta p. 13. & 15. eundem ſinum ſic inquireſ:  
Quia latitudo communis eſt 38 gr. 40 min. & complemen-  
tum ſemidifferentiæ longitudinis 80 grad. 40 min. fiat  
praxis

Latus

# LOCORUM DISTANTIIS. 229

Latus majus  $80^{\circ} 40'$  Complem.  $9^{\circ} 20'$   
 minus  $38^{\circ} 40'$  ———  $38^{\circ} 40'$

Comp. prius  $119^{\circ} 20'$  Cōp. post.  $48^{\circ}$  o sinus  $74314$   
 Excessus  $29^{\circ} 20'$  ——— sinus  $48989$

Residuum  $25325$

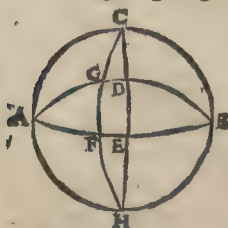
Semissis est sinus quæsitus  $12662$

Cum itaque semidistantia sit utroque modo  $7^{\circ} 31' 16''$ .  
 $27$  sec. erit tota  $14^{\circ}$  grad.  $32$  m.  $54$  sec. hoc est miliarium  
 $218$ , cum quadrante ferè: nam si  $4$  scrupula respondent  
 uni miliarari, ergo unum scrupulum respondet uni miliaris  
 quadranti.

*XI. Locorum tam longitudine quam laticu-  
 dine differentium similiter aut alteruter tantū aut  
 uterq; extra æquatorem est.*

*XII. Si alteruter tantum, distantia ejus ab  
 altero reperitur sequentibus regulis.*

1. Si differentia longitudinis æquetur qua-  
 dranti, ipsa quoque distantia quadrantē æquat.



In præsentī figura data sint loca  
*A & D* sive *B & D*, ut loci *D* la-  
 titudo sit *DE*, differentia longitu-  
 dinis *AE* vel *EB* quadrans. Quo-  
 niam ergo *A & B* referunt polos  
 circuli *CDEH*, proinde per p.  
 12. c. 1. tam *AE & EB* quam  
*AD & DB* quadrantes sunt. Talē

distantiā habet Insula *S. Thomæ* ab orientali lītore *Fa-  
 maicæ*, à Freto *Magellanico*, & ab estio *Gangis*, nempe à sin-  
 gulis distat  $90^{\circ}$  gr. h. e.  $1350$  miliaribus.

*XIII. 2. Si*

XIII. 2 Si differentia longitudinum quadrante minor sit, ipsa longitudinis differentia & latitudo loci istius unius sunt crura trianguli rectanguli prosthaphærerici, cujus hypotenusa, quæ sitam locorum distantiam referens, invenitur per p. 15. c. 7.

Dentur in proximè præced. schemate loca B & G: dantur in Triangulo BEG ad Rectangulo latera BE differentia longitudinum & EG latitudo loci G, quibus data per p. 15. c. 7. vel etiam per alias regulas rectangulorum invenitur hypotenusa BG.

Exempli gratia queratur quantum Lisb. bona distet ab ostio Rivi grandis Amazonum, de quo ad p. 9. meminimus. Viriusque loci longitudinem antea habuimus. Lisbone erat 22 gr. 40. min. Rivi grandis 345 gr. differentia 322 gr. 20 min. cum sit major semicirculo, complementum ejus ad integrum Circulum 37 gr. 40. min. pro differentia long. assumitur. Latitudo Lisbone 38 gr. 40. m. Talis ergo calculus est:

FG	38 40	Complem.	51 20
FB	37 40		37 40
	76 20		89 0
Compl.	13 40		sinus 99985 sinus 23627

Summa 123612

Semissis, 61806 est sinus

arcus DG 38 gr. 10. m. cujus complementum 51 gr 49. m. est distantia BG quæ sita, nempe 777 miliarium cum quadrante circiter.

XIV. 3. Si differentia longitudinis quadrante major sit, latitudo loci & complementum



# LOCORUM DISTANTIIS. 231

tum differentie longitudinis ad semicirculum sunt parimodo crura  $\Delta$ li reſt anguli proſtha-phæetici, cujus hypotenuse complementum per citatam p. 15. c. 7. inventum cum quadrante componit distantiam quaſitam.

Viſi dentur loca A & G, differentie longitudinis A F complementum FB, cum latitudine GF loci G exhibet idem, quod ante,  $\Delta$ lum BFG, ubi inventus arcus GD, complementum ſcil. hypotenuse BG, cum quadrante DA exhibet distantiam GA quaſitam.

Exemplum. Sumatra Inſula ſub æquatore ſita ſic eſt ut litus ejus occidentale diſtet a primo meridiano Lanſonico 140 gr. Promontorium Magellanica, cujus jam ad p. 8. mentionem fecimus, litore Orientali ab eodem meridiano diſtat 30 gr. differentia itaque longitudinum 110 gr. Latitudo hujus promontorii 47 gr. 30 min. australis. Calculus distantie talis eſt, complemento differentie longe- ad semicirculum assumpto 80 gr.

70	Complement.	20	0
47 30	————	47 30	
117 30		67 30	ſinus 92388
Ext. 27 30	————		ſinus 46175

Reſid. 46213

Semiſſis 23 106 eſt ſinus arcus DG 13 gr. 22<sup>1</sup>/<sub>2</sub> m. cui additus quadrans DA produ- cit distantiam quaſitam GA 103 gr. 22<sup>1</sup>/<sub>2</sub> m. id eſt, mill. 1550 cum ſemiſſe circiter.

XV. Si locus uterq; diſtet ab æquatore, latitu-  
P. do vel



# LOCORUM DISTANTIIS. 233

portionais secundus: Sinus totus est primus: tertius autem est sinus versus differentie longitudinum.

5. Inventus per calculum quartus proportionalis si fuerit equalis sinui recto membri secundi; distantia quaesita est quadrans: sin eodem fuerit minor; defectus est sinus complementi distantie quaesitae: si major; excessus est sinus excessus distantie supra quadrantem. Quod si differentia longitudinis fuisset quadrans, quartus proportionalis per p. 15. sola prosthapharese inventus perpetuo est sinus complementi distantie quaesitae.

Exemplum nunc addemus.

I. Vbi differentia longit. est quadrans, hoc est, angulus BDR rectus:

Plimmouthum, celeberrimus Angliae portus, longitudinem habet in tabb. Fansonicis 27 gr. 5 2 min. latitudinem 5 1 gr. cujus complem. 39.

Xaques, nobilis etiam Americae portus in Sinu Mexicano, habet longitudinem 297 gr. 5 2 m. lat. 20 gr. cujus complem. 70.

Differentia long. 270 gr. h.e. 90 gr. per cons. p. 6. huius Auct.

Compl. latit. min. 70 Latit minor 20  
maj. 39 ————— 39

Compos. prius 109 Comp. post. 59 sinus 85717  
Excessus 19 ————— sinus 32557

Residuum 53160

Semissis 26580 est sinus

15 gr. 24 m. 5 2 sec. cujus complementum 74 gr. 35 m. 8 sec. est distantia Xaques & Plimmouthi, facit miliaria Germ. 1118 cum quadrante circiter.

R 2

II. Vbi

# 234 DE SUPPUTANDIS

**II.** Vbi differentia longitt. est quadrante minor, hoc est, angulus L D R acutus:

Juxta particulares Iansonii tabulas est

Dantiscæ Long. 53 45 Lat. 54 20 Compl. 35 40  
Lutetiæ Long. 35 35 Lat. 48 30 Compl. 41 30

Differ. Long. 18 10 qua cum consentit Origanus.

Compl. latit. min. 41 30 Latit. minor 48 30  
maj. 35 40 — — 35 40

Compos. prius 77 10 Comp. post. 84 10 sinus 99482  
Complem. 12 50 ————— sinus 22212

Diff. Longit. 18 10  
Cujus sinus versus 4985

Residuum 77270  
Semissis 38635

100000 ——— 38635 ——— 4985. Operatione calculi peractâ proveniunt 1926 (eadem proveniunt, si secundo & tertio termino proportionali tanquam sinibus re-ctis inquirantur competentes arcus, arcuumq; complementa instituat operatio prostbapheretica juxta reg. 2. Coronidis Trigonom.) quæ subtracta à sinu posterioris compositi 99482 relinquunt 97556 Sinum 77 gr. 18 m. 26 sec. quorum complementum 12 gr. 41 m. 34 sec. est distantia harum urbium quæ sita, miliarium scil. German. 190<sup>4</sup>.

**III.** Vbi diff. longg. est quadrante major, hoc est angulus ad D obtusus:

Almeria urbs Americæ in sinu Mexicano, &  
Gibraltar ad fretum Gaditanum.

Illius longitudo 290 Latit. 20 40 Compl. 69 20  
Hujus longitudo 28 Latit. 36 10 Compl. 53 50

Diff. Longitt. 262, hoc est, 98 per cons. p. 6. hujus Aust.  
Compl.

# LOCORUM DISTANTIIS. 235

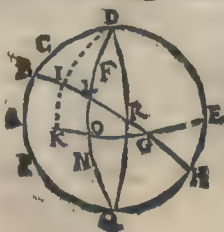
Compl. latit. min.  $69^{\circ} 20'$  Latit. minor  $20^{\circ} 40'$   
 maj.  $53^{\circ} 50'$  —————  $53^{\circ} 50'$

Compos. prius  $123^{\circ} 10'$  Comp post.  $74^{\circ} 30'$  sinus  $96363$   
 Excessus  $33^{\circ} 10'$  ————— sinus  $54708$

Diff. Long.  $98^{\circ} 0'$  cujus Summa  $151071$   
 Sinus versus.  $113917$  Semissis  $75535$

$100000$  —————  $75535$  —————  $113917$ . Calculo  
 absoluto proveniunt  $86047$ , (Eadem proveniunt si secun-  
 do termino proportionali assumo ut sinu recto, & tertio ut  
 tangente vel secante, operationem prosthaphereticam insti-  
 tuas juxta 3. regulam coronidis trigonom.) que à sinu po-  
 sterioris compositi  $96363$  detracta relinquunt  $10316$  li-  
 num  $5$  gr.  $55$  m.  $16$  sec. quorum compl.  $84$  gr.  $4$  m.  $44$  sec.  
 est distantia Almeria & freti Gaditani, nempe miliar.  
 Germ.  $1261$ .

XVII. Si denique latitudo unius sit septen-  
 trionalis, alterius meridionalis, quia tunc dato-  
 rum usitati trianguli laterum unum est majus  
 quadrante, pro illo Triangulo assumitur oppo-  
 situm, cujus latera data sunt complementa lati-  
 tudinum utriusque loci, comprehendentia an-  
 gulum, cujus mensura est complementum dif-  
 ferentiae longitudinum ad semicirculum: ideo.



que etiam lateris tertii cal-  
 culo inventi complementum  
 ad semicirculum est quaesita  
 locorum distantia.

In praesenti schemate cogiten-  
 tur data loca L & H, ut solvendum  
 veniat  $\Delta$  lum D L H, cujus latus D

P 2

H sem.





# LOCORUM DISTANTIIS. 237.

Huius sinus posterioris compositi 93867 relinquit 45627  
sinum 27 gr. 8 min. 48 sec. excessus tertii lateris supra  
quadrantem: ideoque huius excessus complementum ad  
quadrantem reliquum (idem cum totius lateris tertii com-  
plemento ad semicirculum) nempe 62 grad. 51 m. 12 sec.  
est distantia Capitis Viridis & Capitis Bonae Spei, miliar.  
scil. 943.

## II. A Capite Bonae Spei ad Moluccas, in specie ad Ternaten.

Illius longit. 57 Latit. 34 30 merid. Compl. 55 30  
Huius longit. 164 Latit. 1 0 septen. Compl. 89 0

Diff. Longitt. 107 Compl. ad semicirculum — 73 0

Compl. latit. min. 89 0 Latit. minor 1 0  
maj. 55 30 ————— 55 30

Compos. prius 14430 Comp. post. 56 30 sinus 83389  
Excessus 5430 ————— sinus 81412

Angulus datus 73 0

Summa 164801

Cujus sinus versus 70763.

Semissis 82400

100000 — 82400 — 70763. Quartus propor-  
tionalis proveniet 58308 (quantum etiam prosthapherei-  
cè modo prius indicato invenies) qui detractus à sinu poste-  
rioris compositi 83389 relinquit 25080 sinum 148. 31.  
m. complementi tertii lateris ad quadrantem: cui additus  
alter quadrans (quod perinde est ac si ipsum latus tertium à  
semicirculo subtraxeris) componit 104 gr. 31 m. ipsam  
Capitis bonae spei & Insulae Ternates distantiam, nempe  
miliar. Germ. 1568.

Hinc

Hinc sequitur brevissimam Capitis viridis & Moluccarum distantiam esse 251<sup>1</sup>/<sub>2</sub> miliarium.

---

Ita, Lector, breviter habes methodum supputandarum locorum distantiarum elegantissimam: nec ullus tibi casus occurrere potest qui non ad harum regularum aliquamquadret. Fruere &  
Vale feliciter.

F I N I S.



## Ad prop. 15. cap. 5. Trigonom.

## SCHOLION

*Angustiâ paginarum suo loco exclusum.*

In Canone Triangulorum ad partes Radii 100000 confecto videre est exempli gratia 88 gr. 41 min. Sinum esse eundem cum sinu s. rupuli sequentis, idemq. fieri circa alia hujus & 87 gr. vicina minuta, imprimis post 89 gr. 30 min. Item Secantes plurium primi & secundi gradus minutorum sibi proximè succedentium sæpè sunt eadem. Unde calculus circa Secantes duorum primorum & Sinus duorum ultimorum graduum planè lubricus est, nisi ipsi sub-veniatur Simbus & Secantibus horum graduum ad partes Radii 10000000 supputatis: quas accuratioris calculi gratia post finem nostri Canonis exhibere putavimus operæ pretium.

Neque obstat, etsi ad calculum utaris diversis Canonibus, modò sequentes observentur cautele.

1. In Triangulis planis nunquam omnes tres termini proportionales dati sunt Numeri Canonici, velut è p. 9. c. 6. constat.

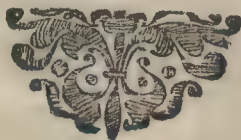
2. In sphericis etsi interdum omnes tres esse Canonici possent, non tamen omnes ex isto binorum graduum particulari Canone sumantur, sed primus tantum & reliquorum alteruter: sin omnino sumendi sint, operatione calculi peracta quartus inventus videm in eundem immitatur Canonem. Cujus limites si excesserit, characteribus duobus ultimis (dexterrimis) diminutus congruet ad Canonem priorem integrum. Quod si characterum rejectorum summa superet numerum 50, reliqui augeantur unitate.

3. Itidem in Triangulis planis cum quarto proportionali fiat, si fuerit Canonicus.

4. In Triangulis planis si quartus proportionalis fuerit latus Trianguli, secundus autem vel tertius fuerit Canonicus, è Canone particulari desumptus; quartus duobus ultimis characteribus imminutus determinat quantitatem lateris quesiti, sed ut juxta schol. p. 4. c. 6. Trigonom. fractio attendatur, cujus numeratorem exhibent rejeſti characteres, denominatorem ſemper centenarius.

5. In  $\Delta$ lis planis ſi non tantum ſecundus vel tertius ſed etiam primus è Canone particulari deſumptus fuerit; quartus retinetur immutatus.

In cæteris etiam caſibus omnibus proportio quarti manet inturbata.



Ne ſequentes paginae nullo fruſtu vacarent,  
viſum eſt appendere ſequens Problema Geodæticum;

Eine



*R 1 ar 241*

# Eine Aufgabe

Den jenigen Landmessern (so in Preuss  
 sen so wol Königlich als Fürstlich theils jetzt  
 fast so gemein sind als die Poeten ) welche ver-  
 meinen / die vollkommenheit ihrer Kunst  
 könne wol bestehen ohne doctri-  
 na Triangulorum.



*Hand ist Maass  
 und solches be-  
 ist nicht erisich  
 fests als Längen  
 Heil, ein legation  
 et ist ein Ge-  
 metris*

**E**s ist ein Ort Landes / davon wolte man  
 gern 3. Zuben abnemen / so / dass die  
 Grenzen seyn sollen erstlich ein Zaun  
 vorlengst einem alten Graben ABCDEFGH,  
 darnach ein Fluss vorlengst H I L, &c. vnd  
 dann ein schnurrechter Graben I A oder L A  
 oder wo ihn die maass vnd rechnung würd  
 hinstrecken. Die Gerade von H gegen A  
 kan man wol abschen / auch messen / vnd ist  
 zum Exempel 224 Ruten: hernacher aber  
 von

von I, L, K, O, daß man gegen A, wegen das  
zwischen schießenden Waldes nicht sehen.



Nun ist gleichwol die Frage / weil der  
Winckel A H I nicht winckelrecht / sondern  
zum Exempel obtusus ist / Wie lang die  
Grentz vorlengst dem Fluß seyn werde/vñ  
da sie etwan bey I (oder neher gegen H) sich  
endete/wie groß der winckel A I H item I A H  
seyn muß/damit die Gräber den Graben I A  
schnurrecht treffen mögen.

Weiter da sich zutrüge/daß die Grentz-  
lenge vorlengst dem Fluß lenger denn H I  
durch die rechnung gefunden würde/ als daß  
sie sich etwan biß zum N erstrecken solte/vñd  
aber der Fluß bey I sich gegen O wendete/  
so müste/ wie die vernunft vñd augenschein  
gibt / die dritte Grentz nicht L A behalten  
werden/ sonst würde an den 3 Zuben so viel  
mal

mangeln als der Triangel I L N. Das zu erst  
 statten muß man mit der Grentz von L ge-  
 gen O ferner rücken/aber doch nicht biß ans  
 O daß I O so lang würde als I N : denn also  
 were der Triangel O A L weit grösser als I  
 L N : sondern man müst etwan rücken biß  
 zum K, daß der Triangel K A L so groß wür-  
 de als I L N. Ist aber die Frage wie lang I K  
 seyn müste/ Item wie groß alsdan die win-  
 ckel I K A vnd K A I oder K A H möchten  
 werden?

Die Rutt allhie in Preussen helt 15  
 Werckschuch :

Drey hundert gevierdter Ruten machen  
 einen Morgen :

Dreissig Morgen machen eine Zube

Dis ist kein vnnütz Exempel / sondern ist mit  
 in Warheit selbs vor dreyen Jahren begegnet.



**Pag. 41.** ad finem scholii p. 3 i adjice:

Hujus subtense semissis HF vel FC  
est sinus rectus arcus CD vel DH  
ad arcum CH subdupli, per p. 23.  
hujus.

**Pag. 204.** lin. antepenult. sic lege:

dextros abscissos, & hujus character  
superfluus in terminum priorem in-  
tegrum: productorum summa &c.

Præter hæc sphalmata nulla, quæ lecto-  
rem impedire vel turbare possunt,  
reperientur.

# Problema

Propositum Geometris istis (quorum p. Borissia  
tam Regionem qm. Ducalem tanta est copia  
quanta Poetarum) q. putant Perfectionem  
Arts sue subsistere posse et absq. tina  
Alorū.

Esto ager, a quo fiat auferendi et populari  
mensura determinandi ex grā 3 Manſi, ita q. tem  
ut limites fiat 1 Sepes juxta fossā quādam obliq.  
A B C D E F G. H, 2 Fluvius juxta lineā in  
ripa H I L K etc 3 fossa fossa rectissima  
I A vel L A vel quāvisq. calculi et mensura  
monstrabunt. A pundo H ad A patet spectus  
et ipsa H A mensurari potest, <sup>situs</sup> ~~altus~~ 224 perthicarū.  
Sed ab I, L, K, O, spectus ad A ~~per~~ interjectam  
sylulam non patet.

Nihilominus querit, quoniam angulus A H I non  
est rectus sed exi grā obliq., quāto sit sitūz  
limes juxta ripam fluvii? Et si forte ad I  
terminat, quāto sitūz sit angulus A I H et I A H, et  
fossas fossa I A rectissimā p. sylulam forte possit?



(vel alio loco) fluvius a linea recta deflecteret,  
quod est

Porro si eveniret, ut limes juxta ripam fluminis longior per calculum evaderet quam est  $HL$ , atque ita cum flexura ripae flectens, esset et ipse limes, quod est deinde, quousque adhuc ab  $L$  in  $versus K$  mensurandum sit, e. g. an in  $L$  aut  $K$  aut  $O$  etc. Item quid tunc evadat angulus  $A$   $K$   $L$  et  $L$   $A$   $K$ ?

quadratus

Pertica Borussica gignit 15 pedes
300 Pertica efficiunt Jegerum talis Morg
30 Jigga Mansum talis Wtaka

Itaque mansi area portuam 9000

Est autem Mansi portuam ad Lunum

Transmonium proportio quod est 25 ad 36. exacte.

Itaque area Lunus Transmonium est  
portuam 12960.

In nonnullis exemplaribus Trigonometriae  
§ Septima ad hoc errata deservient

Pag. 1. Dedicatiois lineâ à fine s lege: wårthop

Pag. 43. lin. 5. ad numerum XXXIX adice hunc: s.

Pag. 44. Solutio pp. 43. sic lege: In primâ fig. figura  
sicut e 10 tangens arcus 1 Y ad 1 D tangenti  
arcus 1 C, sic quæ dico E B tangenti arcus  
C E, qñti sc. arcus 1 C, ad E V tangenti arcus  
E Y, qñti sc. arcus 1 Y. etc

Pag. 51. p. Communia, lege: Compendia  
54. lin. 18. et 23. lege: 56345 lege 56335.

56. lin. 21. p. medio contra, lege: media contra.

In tabulis, gradus 3 si p lineâ qñti 99784 lege 99774.

Pag. 167 lin. 11. p. Dato lege Ciasito

198 lin. 5. p. Unig, lege: Angulo qñti adjacentis

236 lin. 17. p. 39 30 lege 39 40

237 lin. 7. p. 1943 lege 943.

238 lin. 2. p. 2710 lege 2511.

1 on page  
6-25-17

Synonae et est synonymae vocabulum  
est visitatum. Hic enim et Viciat quod  
postea usurpatur ab aqua libratilibus.  
An vero istud Synonae sumptum est a  
nomine sinum? <sup>Id quidem</sup> ~~Id~~ notarium diligenter  
ter contra hoc qui melius hoc est sy-  
nuiq. absq. sinibus. Neq. movetur suspicio  
si nomen hoc usurpatum est Poloni ex ali-  
qua lingua. Nam neq. Latinorum propria  
vox est. Ab Arabibus nempe assumpta.  
Cumq. superioribus seculis Arabes omnes  
fere literas tractarent: in Averroe enim  
philosophia effloruit: in Avicenna medi-  
cina, in Gebero physica metaphysica vel  
<sup>Cathari</sup> ut vocant Alchymia et mathematica ar-  
tes: non est mirum si ab Arabibus in-  
de omnes petebantur scientiae vox sinum  
ad Latinos atq. gentes atq. adeo  
Sarmatas cum Polonos cum per alios  
Rum praecipue Vithellum Optici  
praeclarissimum scriptorem pervenit.

constat sane Vitellionem ex Arabe  
Alhazeno multa assumpsisse. Tanta  
vero apud auctores nomen sinuosa  
erat, ut inde aliam lineam novam  
na desumerentur: quas enim nunc  
Tangentes in Canone Geometrico vo-  
camus, eas alii doctissimi viri pre-  
cipue <sup>Franciscus Vitellio</sup> Adrianus Romanus cumq;  
eo plurimi Prosimus vocauerunt.  
Secantes vero Transsinuosas.

Nominat autem Vitellio terram  
Poloniam suam lib. x. Bar. 74  
in aspera inquit terra, sed et  
Polonia, habitabilis quae est  
circa latitudinem 50 graduum.

Nihil vero ad Geometriae primum expe-  
ctat Canone geometrico vel ut alii  
vocant Canone Mathematico. Geometricus  
erat sententia altissimi Francisci Vie-  
ti quam primum hypotesis Canonis  
Mathematici. Ex angulis laterum, vel  
ex lateribus angulis, et mixtim in trian-  
gulis tum maior quam solidis assequi sum-  
ma gloria Mathematici est. Sic enim



